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VIVISECTION

INVESTIGATED

AND

VINDICATED

BY

GEORGE F. ETHERINGTON, M. D.

F. S. A. F. B. S. etc.



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TO
SAMUEL WRIGHT, M.D., F.R.S.S.A.,
PHYSICIAN TO THE BIRMINGHAM GENERAL DISPENSARY,
&c. &c. &c.,

IN TESTIMONY OF THE HONOURABLE BUT ENVIABLE POSITION WHICH HIS
EXTRAORDINARY TALENTS AND INDUSTRY HAVE GAINED FOR HIM
AS A SCHOLAR, A MAN OF LITERATURE, AND AN
ORIGINAL AND SUCCESSFUL INVESTIGATOR
OF MEDICAL SCIENCE ;

IN ADMIRATION OF THOSE VIRTUES WHICH CONSPICUOUSLY YET HARMO-
NIOSLY BLEND THE DIGNITY OF THE SCIENTIFIC CHARACTER,
WITH THOSE ENDEARMENTS AND AMIABILITY OF
HEART WHICH FORM THE PRIDE AND
ORNAMENT OF PRIVATE AND
POLISHED SOCIETY ;

IN THE FERVENT HOPE THAT THE MORNING OF HIS PUBLIC LIFE
WHICH HAS SO BRILLIANTLY AND AUSPICIOUSLY SET IN, MAY BE
CONTINUED TO THE EVENING, TO ADD TO HIS
USEFULNESS, AND TO MULTIPLY HIS
ALREADY WELL-EARNED
LAURELS ;

AND IN AFFECTIONATE REMEMBRANCE OF THE HAPPY TIME WHEN WE
WERE WONT TO MEET IN THE SCIENTIFIC HALL
AND PRIVATE CIRCLE ;

THE FOLLOWING PAGES

ARE DEDICATED,

BY HIS SINCERE AND EVER FAITHFUL FRIEND,

THE AUTHOR.



P R E F A C E .

THE intention of inquiring into the nature of Experimental Physiology originated in the following circumstance :—

At the commencement of the Winter Session. 1839-40, a brilliant discussion took place in the HALL OF THE ROYAL MEDICAL SOCIETY OF EDINBURGH, in which my friend Dr. Samuel Wright was engaged, and on which occasion he stood alone as the *vindicator* of Experimental Physiology; he was opposed by and had to meet the arguments of distinguished members, backed as *they* were by the opinion of a large majority of the Society. I remained a silent but observant spectator of the whole proceedings, and was not more delighted than astonished at the ease and success with which Dr. Wright met and *annihilated* the argu-

ments and eloquence which for some time continued to be poured upon him. Yet Dr. W. maintained his position; and after a few charges from both sides, I observed that his opponents gradually retired from the field of controversy, and the wreath of victory was awarded to my friend.

The animated discussion of that evening forcibly recalled to my recollection what history has transmitted to us of the talent and eloquence which characterized the bye-gone days of that venerable building, and I was almost constrained to think that the mantle of the illustrious departed had descended upon us.

At that time I was engaged in writing a paper, which I was appointed to read before the Society in December of the same year; I immediately requested permission to change it for the following one, entitled "An Inquiry how far Experiments on the Lower Animals are calculated to Assist in Scientific Investigations," which was granted. Shortly after reading this paper, I further requested to be permitted to print it, which was allowed, "on the condition, that it be stated, that it was read before the Society."

Further consideration induced me to lay aside that manuscript, which is the legitimate property of the Society, and I determined to re-write my

thoughts, which have extended to the bulk I now venture to lay before the public.

Notwithstanding the above resolution, I delayed fully eighteen months, before I set about carrying it into effect.

Two reasons prevented me from commencing my task ; the first was, that I hoped some one, properly qualified to meet the difficulties and labours attendant upon it, would signify his intention of vindicating a cause, which, before, had never been attempted, and in which I stand alone, as the humble supporter ; the second was, that I felt so much my inability to do the subject anything like ordinary justice, that I dared not commence.

However, as no one seemed disposed to come forward, my private feelings, as well as public promise, required that I should not any longer delay, but commence the task, and do my best in carrying it out.

The present work, then, was commenced at the beginning of August of last year (1841), and was sent to press early in January of the present year.

But, although it was in hand four months, it did not receive my undivided attention. Its progress suffered many interruptions, partly from the indisposition under which I have lately laboured, but principally from my professional duties, which

I did not feel myself at liberty wholly to suspend.

I consider it but common justice to myself to explain this matter, because the disappointment, which I am too well aware will be experienced from my poor endeavours, may now find some alleviation.

I further think it necessary to offer a brief explanation of, and apology for, the *peculiarities* which I believe characterize the following pages.

I have endeavoured to vindicate the Experimentalist, by a double method. First, I have laid a broad foundation on FACTS, and, in the second place, I have attempted to answer the principal objections which have been advanced by those who have written against the Science.

I beg my readers will weigh my endeavours in the following scale :—First, by considering the *spirit* in which I have written ; and second, the *object* for which I have written.

If my manuscript had been as many years on my desk, that it has been months, I, then, should consider myself highly blameable for the many imperfections in style, which will too plainly show themselves. I would prefer that my pages should be considered in the light of written conversation, rather than of book-writing. I have freely availed myself of authority, and occasionally,

I have introduced an episode, by way of relieving the attention of the general reader.

But, I must not further extend this egotistical survey.

MR. SHARON TURNER has so aptly embodied my ideas on the present topic, that I shall venture to borrow from, and cloak myself under the following passages from his pen:—

“But as every contribution will be of service, I will proceed to submit mine to your consideration, although I cannot but be aware that the imperfection of the attempt may disappoint the friendly expectations of some whom I should be happy to please. The trains of thought which will be pursued may not be those that they would have preferred: the views exhibited may not coincide with theirs: sentiments may be expressed which they may occasionally hesitate to approve. Such results cannot but be painful to the writer, and yet must be risked, or nothing can be written. No work can be satisfactory alike to all. Our knowledge, our reasonings, and our tastes, differ too much in each of us, for anything like intellectual uniformity with each other, to be an individual characteristic. We may agree in principle, wish, and feeling; but in the particular occupation of these, a variety of inference and judgment always appears.”

I hope I may be allowed to express the extreme gratification which I experienced from reading the following note, which I transcribe from the letter of a medical friend, dated Vienna, June 8, 1841. "It is curious that the subject of experimenting upon animals was hotly discussed in Berlin during my stay there, and that Müller should have taken almost the same views of the subject which you did in your paper at the Medical Society."*

In conclusion, I cannot refrain from expressing the great pleasure I felt during those hours which were devoted to the following pages.

Cheerfully did I sit up late and rise early until I had completed my work. Such being the case, I regret that my abilities have fallen so far short of the *spirit* that actuated me. I submit the present essay to the tribunal of public opinion, under the deepest sense of its many frailties, because I *feel* that my task has been ill-performed.

G. F. E.

* My friend passed the winter of 1840 in Berlin.—*Author.*

NOTE.—About half of the following pages were in print when the sudden and melancholy death of PROFESSOR SIR CHARLES BELL, was announced.

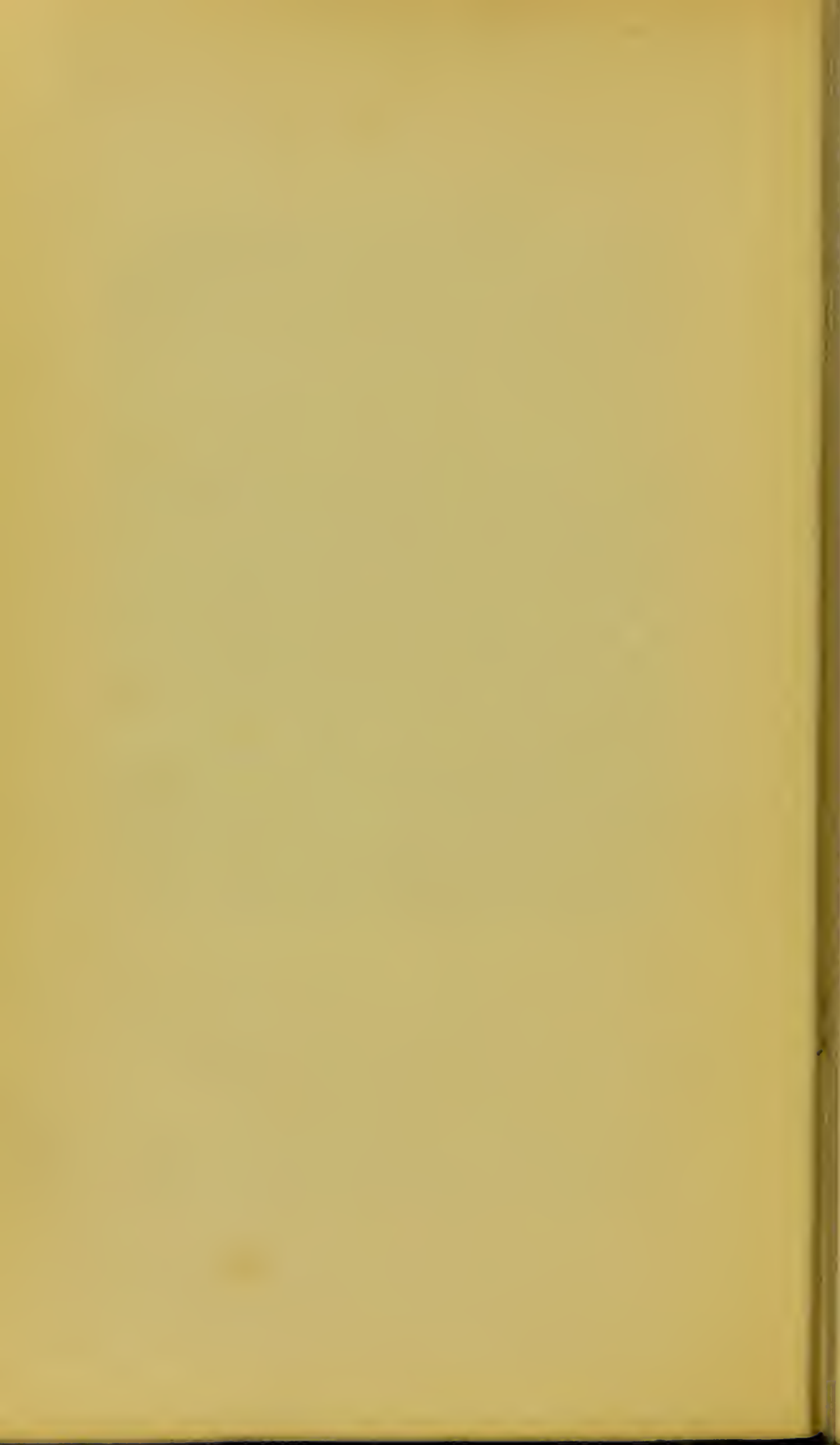
When I asked Sir C. Bell's permission to dedicate my book to him, he said, taking me by the hand, "*But you are writing against me ; however, that has nothing whatever to do with the dedication.*" Two or three times he asked me how my work was coming on ; on one of these occasions I replied that it was in the press, upon which he said smilingly,—"*Then you and I are in the press together.*"

He used to say, at the same time clapping me on the shoulder, "*Now, mind, study FUNCTION.*"

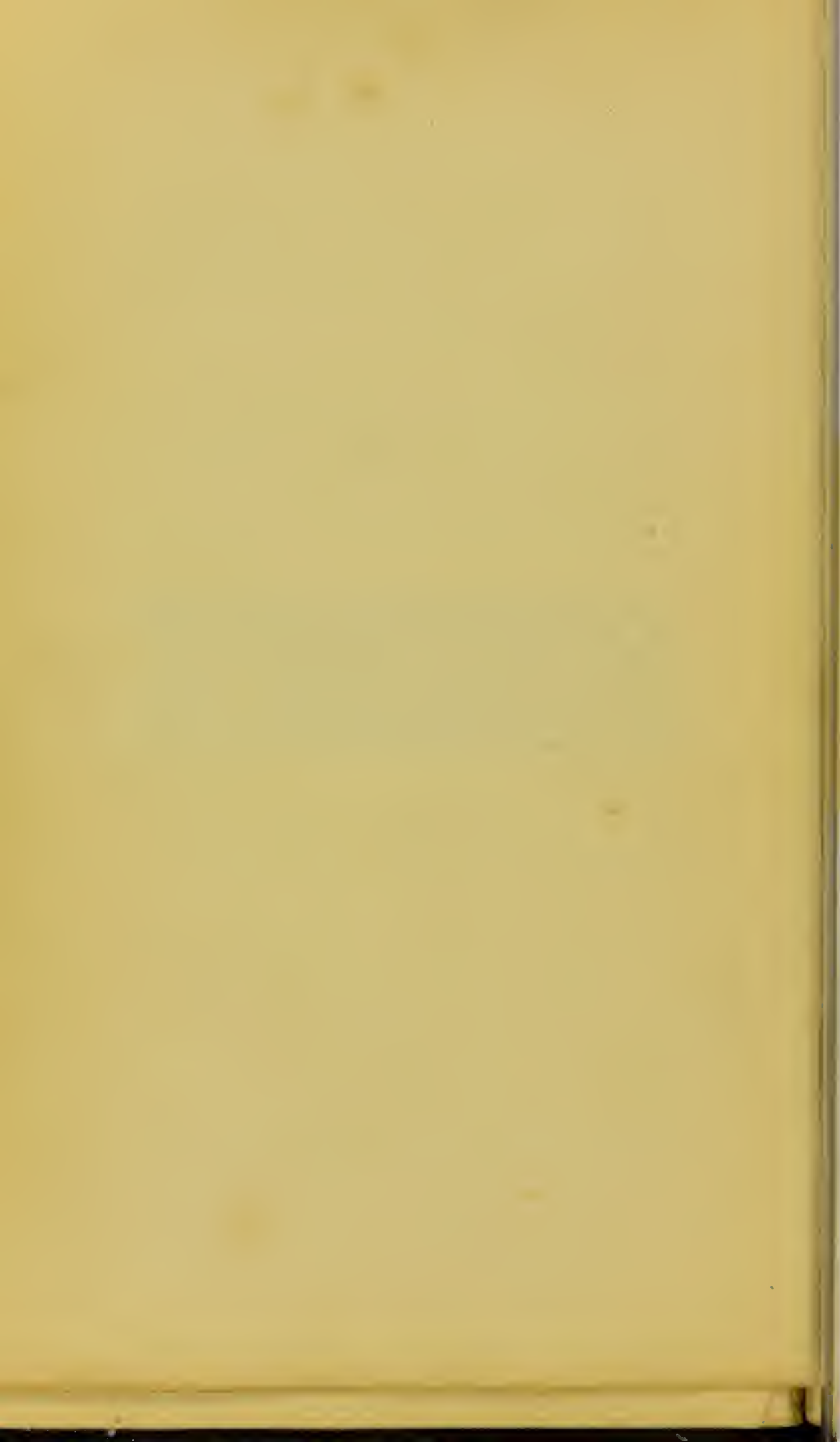
Some time ago, he presented me with "A Memoir" of his life, by Pettigrew, this mark of his favour, and a likeness of him in my possession, is, alas ! all I have now to look to.

My only object in stating these facts, and I could enumerate many more, is, to offer an illustration of the condescension, affability, and encouragement, which he shewed to his pupils.

It was Sir Charles Bell who infused into *my* mind a LOVE for my profession, the study of which constitutes the happiness of my life.—G. F. E.



“The necessity of inflicting a painful death on so many animals, will ever be felt by minds of sensibility, as a cruel alloy to the pleasures of Physiological research. By no other mode, however, than that of experiments on living animals, can any important advance be made in this respect. Such experiments, in a question of mere curiosity, are certainly indefensible; but where, as in the present case, the advancement of truth conspires with the interests of humanity, we must impose silence for a while on the remonstrances of sensibility.”—PROFESSOR COLEMAN’S *Dissertation on Suspended Respiration, Introduction, p. 9.*



ERRATA.

Page 9, line 24, for *drama* read *secrets*.

— 15, — 16, for *rescire* read *nescire*.

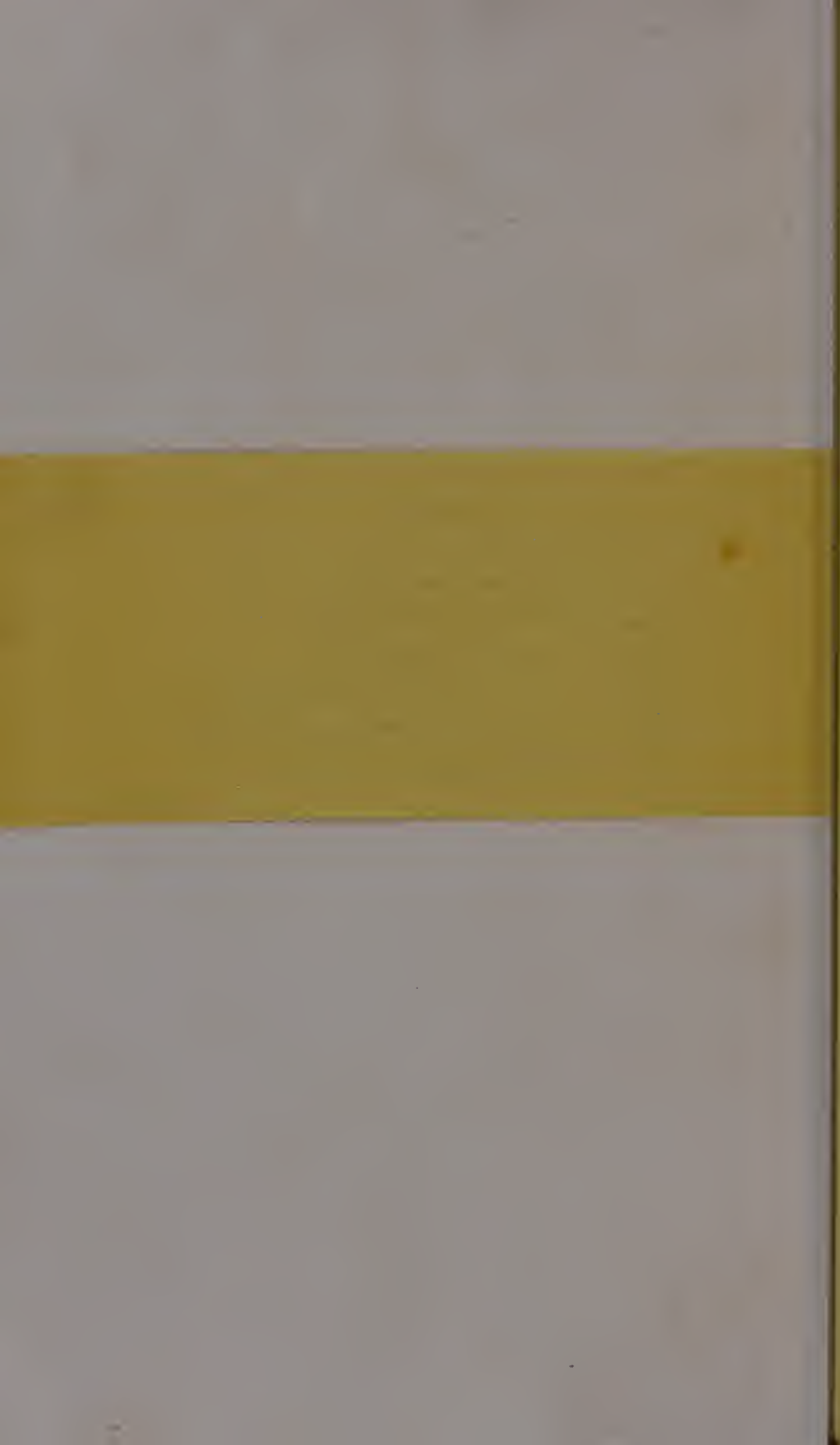
— 15, — 30, for *perpetus* read *perpetuo*.

— 83, — 2, for *Fleuens* read *Fleurens*.

— 110, — 7, for *unchangeable* read *uncharitable*.

— 110, — 17, for *Sir A. Bardsley* read *Dr. Bardsley*.

— 156, — 29, for *pypoglossal* read *hypoglossal*.



PART I.



INTRODUCTORY REMARKS.

The title of our proper subject implies that it is of a purely argumentative nature.

The first question which arises in the mind is, in what sense do we use the word *Vivisection*? Vivisection may be defined to consist in cutting and administering poisons to living animals, by which pain and protracted suffering are occasioned, and not unfrequently, death is the result. How various soever may be the modes in which experiments are performed on living animals, *pain* is the general and necessary attendant on them.*

The mention of pain and suffering inflicted upon those creatures which the Deity has placed within our power, leads to a no less interesting than im-

* The literal meaning of the word Vivisection, from the Latin *Vivus et seco*, is, I cut alive; but as the administration of poisons equally comes under our consideration, we have thought it convenient to extend the term to the latter.

portant question,—Can it be shewn that the ALL-WISE CREATOR delegated to man the privilege of inflicting pain and death upon the lower animals, for the sole purposes of SCIENCE, and for the benefit of SUFFERING HUMANITY?

This is a compound question, and we will reason upon it as follows:—Man is an intellectual and moral being; the object of his intellectual faculties is to acquire a knowledge of animate and inanimate nature, and the use of his moral powers is to direct that knowledge into proper channels, for the best interests of science and humanity.

The physical philosopher may inquire into the innermost secrets of material creation, without inflicting the smallest amount of pain on beings endowed with LIFE; the metaphysician and psychologist may study their own departments with the same freedom. Not so, however, with the scientific physiologist; his province exclusively belongs to the animate creation. Before we proceed further, it may be as well to inquire what we understand by physiology, and what are its uses? “It pretends to nothing less than to explain the phenomena of living nature,—the conditions upon which it depends, and the laws by which it is governed. Hence, it inquires not only into the relations of every component part of an individual

to each other and to the whole, but also, as far as is possible, into the mutual relations of all living things to each other, and to the rest of the world. In its useful application, therefore, it is the foundation of agriculture, of husbandry, and of medicine.”* The physiologist, then, has exclusively to do with beings endowed with life.

The study of physiology† is one department of human knowledge; the calls of humanity cannot be relieved without a successful and minute knowledge of this branch of the education of a physician,—that is to say, the science of medicine cannot be advanced without prosecuting this branch of knowledge; consequently, the conclusion to which we must arrive as to the propriety and legality of causing pain, that physiology may be properly studied, is as plain and self-evident as any mathematical demonstration can be, viz., we are authorized to inflict pain and suffering that the imperative demands of humanity may be appeased.

Our argument is that of a connected chain, in

* Report on animal physiology, by Dr. Clark, Prof. Anat. Univ. Cambridge.

† Expériences sur les animaux vivans, essais avec divers réactifs sur les tissus organisés, dissections. ouvertures cadavériques, observation de l'homme en santé et en maladie : voilà les sources où j'ai puisé ce sont celles de la nature. Je n'ai point négligé non plus celles des auteurs, de ceux surtout pour qui la science de l'économie animale a été une science de faits et d'expériences. *Bichat*, Anatomie Générale.

which one link necessarily depends upon the other for the stability of the whole ;—if one give way, the individual links no longer constitute the chain, and the design of the whole is immediately destroyed. An analysis of the question represents it thus :—

Pain holds the same relation to physiology that physiology does to humanity, and humanity does to the health of the family of man.

If we are not to inflict pain upon the inferior animals, we cannot hope to advance and build up the science of physiology on the only legitimate principles that it admits of, viz., the study of *phenomena*, nor can we expect to remove or alleviate the manifold sufferings of our fellow men.

It is objected to this argument, the Deity never willed that disease in man should be removed by inflicting pain and disease upon the inferior animals ; and to allow such a doctrine would be to admit that He had not constituted the Universe and living nature upon those adaptations of harmony and happiness which we everywhere see around us, and that it is in direct contradiction to the commands of Scripture and the dictates of our moral feeling.

We shall have little difficulty in showing that this argument is more plausible than true ; in short,

that it must give way upon the slightest examination. We will take an illustration from physical nature. Pain and death are too frequently the consequence of lightning during a thunder-storm ; (which physical phenomenon is a wise and beneficent intention of Providence to restore that electrical balance in the atmosphere which it had lost, and the derangement of which *must* sooner or later place our planet in a precarious condition, and necessarily involve animal and vegetable life to a very great and ruinous extent.) Now, the physical philosopher says, here is an admirable instance of a law by which the safety and harmony of the universe is preserved. Which law may thus briefly be expressed (and it forms the grand basis of our argument) :—*A lesser evil must be submitted to that a decided good may result.* He (the physical philosopher) does not speak of and lament the operation of this physical phenomenon, because he is told that one or more men lost their lives, or because so many head of cattle were lost to their owner,—No ; he says, we must submit to the dispensations of Providence, and rejoice that more lives have not been sacrificed,—we must rather submit to the loss of one or more friends than see our planet in disorder, and the whole of the human race in jeopardy. In like manner, the physiolo-

gist had better inflict suffering and death upon the lower animals for the elucidation of those minute and obscure points connected with the *functions* or the operations of the various organs which constitute the frame-work of man.

It is of essential importance to our argument that we attach definite ideas to the terms we employ.

We have spoken of *life*, *phenomenon*, and *function*: what do we mean by these abstract terms? "Life is the sum of the actions of organized beings."* That is to say, life forms the grand characteristic between organized and inorganized matter. This is all we mean by life. The question, "What is life?" is one we do not presume to discuss. This definition, then, will answer our purpose in this essay. Again,—In what sense do we use the term "phenomenon"? We may say that phenomenon means the change or action going on in any one organ, while function is applied to the action of an *apparatus*, or a series of organs or parts.

We now recur to the question with which we set out, and we answer it in the affirmative. Indeed we cannot imagine that it admits of the

* Fletcher. La physiologie, en général, est la science qui traite des phénomènes de la vie, et la physiologie de l'homme, en particulier, est celle qui traite des phénomènes de la vie de l'homme.—*Adelon*.

smallest doubt. Knowledge was given to man as well for his corporeal as spiritual interests; if disease, that is, its nature, cannot be detected without studying the various functions in living bodies, and if the lower animals were given to us for our use; it necessarily follows that the Deity willed that we should use the inferior animals in what way soever we considered best to forward our interests; and consequently that He permitted us to examine the functions and phenomena continually going on within them, if, by that examination, we could arrive at any observations and facts, which would enable us to alleviate and cure many diseases, of the nature of which we were formerly ignorant.

It has been argued, however, that physiology can be successfully prosecuted without having recourse to experiments on living animals; that it is not safe to trust to the often faint analogy which subsists between the mental and physical organization of man and the lower animals; and that observation and the examination of healthy and morbid structures in the dead body, are abundantly sufficient to give us accurate views of disease, and to suggest modes of cure or alleviation for it.

These objections introduce us into a wide field, upon which we shall now enter.

First, 'physiology can be successfully prosecuted without having recourse to experiments on living animals.'

"Physiology is the science of life;" * in other words, "that branch of natural science which has for its object the knowledge of the phenomena proper to living bodies." † Phenomena are changes or actions going on in any one organ of the living body.

How then can physiology be studied without the phenomena of living bodies? The negative of this question amounts to an absurdity, which expression the view of the subject obliges us to employ, by which, however, we do not intend the slightest disrespect to those who differ from us in opinion.

Second, 'It is not safe to trust to the too often faint analogy which exists between the mental and physical organization of man and the lower animals.'

Philosophers and physiologists of the highest repute are of opinion that the most striking analogy exists between the mental and physical organization of man and the lower animals. ‡

The Appendix (1.), (2.) may be consulted for authority on this subject, and I shall not enter up-

* Richerand.

† Majendie.

‡ See a paper on instinct by the author, in which he has endeavoured to show that the intellectual faculties of the lower animals differ from those in man, *in degree*, not *in kind*.

on the refutation of an opinion which hourly observation contradicts.

Third, Observation and the examination of the healthy and morbid structures in the dead body are sufficient to give accurate views of the nature of disease, and to suggest modes of cure or alleviation for it.

All are agreed upon the axiomatic truth, for which we are indebted to LORD BACON, that OBSERVATION and EXPERIMENT are the only sure media of human knowledge. Concerning observation it is sufficient to say, that the more highly this faculty is possessed, the greater is the power of discriminating one disease from another; in one word, it is the possession of this faculty which places one physician before another, and which enables him to trace disease where common observation would not have detected it. The immortal author just cited speaks of "dissecting and anatomizing the world" so convinced was he of the importance of "experiment." Appendix (3.) The physical philosopher will at once acknowledge that *many* discoveries may be traced to this mode of searching into the ^H drama of nature, and that there ^{H breaks} is much he expects to achieve by this manner of investigation.

If, then, *experiment* be the *sine qua non* to the

natural philosopher, how much more so must it be to the philosophical physiologist?

We most unhesitatingly answer our third proposition in the negative. Indeed we dispute the correctness of the proposition *itself*.

“Observation and the examination of healthy and morbid structures in the dead body,”—Now, we have every reason to believe that decomposition commences whenever stiffening of the body has taken place. Rarely are bodies opened after death until twenty-four hours have elapsed; consequently, considerable change *must* have taken place in the tunics of the various organs, (though it may not be perceivable by the physical eye) during that space of time, so that in the strict sense of the term, we cannot say that we ever witness *healthy* structures in the dead body.

But laying aside what some may call a refined distinction, we still maintain that the examination of dead bodies is insufficient to give accurate views of the nature of disease.

If a change so rapidly comes about in a healthy organ in the dead body, how much more rapid will be the change in a diseased organ?

Still more, how is it possible to acquire a knowledge of healthy structures from the examination of the so called healthy structures in a dead body—inanimate matter!

To take an illustration from what we may call physical life. With as much propriety might we wish to know the construction of the steam-engine, or of a watch, by looking upon the outward movements of the one, or the minute hand of the other.

We know that *motion* is the result of the action of the former, but we can never ascertain the *cause* of this motion by merely looking upon the machinery in action. To arrive at a knowledge of the power which sets the machinery in motion, we must study (by a variety of diagrams) the several parts of which the machine consists, and appeal to the laws of chemistry for an explanation of the generation of steam. The same dissection must be gone through in studying the movements of an automaton.

In like manner to become *properly* acquainted with the many phenomena going on in living beings, we must examine the various processes, (digestion for instance) during life.

If, then, it be utterly impossible to study phenomena in lifeless matter, it must be equally impossible to obtain accurate views of disease and to suggest modes of cure or of alleviation.

We might introduce a number of remarks of equal importance with the foregoing, into this chapter; I am rather of opinion, however, that

repetition will be avoided by reserving much we shall have to write, until we come to the stage in our journey which calls upon us to refute the objections of those who differ from us in opinion. We have not only an argument to sustain, but we have to answer a multitude of objections which have already been advanced against our argument, and to anticipate others which may be raised upon the perusal of our pages.

VIVISECTION INVESTIGATED.

CHAPTER I.

A DISTINGUISHED philosopher and physiologist has said —“ It can never be considered an unimportant or trifling pursuit to inquire how such men as Haller and Hunter reasoned, or by what mode of investigation they were led to the discovery of the truths which immortalize their names.”*

Now, this suggestion is admirable and necessary, and will form a most appropriate introduction to our argument, because we have not only to lay before our readers *what experiments* upon living animals have achieved for science, and consequently for humanity (for the latter must as certainly follow the former as effect follows cause); but it is equally important to ascertain *how* and by *whom*

* Bostock's Elem. Syst. Phys., vol. i. pref. p. vi. 1824.

such improvements were effected, which have gained for them a seat in the Temple of IMMORTALITY, and whose genius* will receive the veneration of ages yet to come !

We read the following very important note from Dr. Young's Introduction to Medical Literature:—"Halleri *Elementa Physiologiæ* : A useful work for reference, but which appeared to me to repay very inadequately the labour of four months spent in reading it through." Now, I cannot but think that Dr. Young has mistaken the object of the distinguished author ; his works are not intended for the *student* of medicine, but for consultation. The circumstance of writing in a dead language, and one *too much neglected* in our day, would afford sufficient confirmation of our opinion ; besides, the number and voluminous nature of the venerable HALLER's writings would completely place it out of the pale of the student to *study* them. Dr. Young has stated an important and interesting fact in telling us how long it would take to read Haller's works. We will, then, transcribe a few passages for the purpose already referred to.

Quando vero ad hunc librum scribendum accessi, dudum in physiologicis laboribus majorem vitæ meæ partem posueram. Neque ergo ignarus adveni magni, quod mihi imponebam oneris, felix, si perinde gerendo suffecero.

* In these pages I shall use the term *genius* as synonymous with *philosophical spirit* ; in other words, "every true poet, and every great inventive author, must be filled with some idea peculiarly his own, and all-powerful over his soul—which is the central point and focus of his intellect—to which every thing else is subordinate—and of which the writings, wherein he embodies his spirit, are but the ministers, interpreters, and tools."—*Schlegel*.

Dissecanda ergo animalia. Verum minime sufficeret cadavera dissecuisse, viva incidisse necesse est. A cadavere motus abest, omnem ergo motum in vivo animale speculari oportet. Sed in motu animati corporis interno et externo tota physiologia versatur. Ergo ad sanguinis circuitum, ad ejus subtiliores motus perspiciendos, ad respirationem, ad incrementa corporis et ossium, ad intestinorum reptatum, et chyli iter intelligendum, absque vivorum animalium strage nihil omnino profici potest. Unicum sæpe experimentum integrorum annorum laboriosa segmenta refutavit. Hæc crudelit, as ad veram physiologiam plus contulit, quam omnes fere aliæ artes, quarum conspirante opera nostra scientia convaluit. Sed et morbosorum cadaverum incisorum plurima commoda sunt. Sit functio cuicumque corporis parti vulgo adscripta; velisque ~~rescere~~ ^{rescere}, num vere id ejus partis officium sit, quod creditur: non certius defines, quam incisis corporibus, in quibus ea pars vitiata fuerit. Si ea functio superfuit, cum id organum vitio laboraret, non est ejus quæ dicebatur, utilitas. Si sublata fuit in eo corpore functio, cujus particula, de qua quæritur, vitiata fuit, valde erit vero proximum, hanc fuisse ejus partis functionem, quæ sublata fuit.

Est in his omnibus experimentis lex, cujus neglectæ pœnas maximi aliquando viri luerunt. Nullum unquam experimentum, administratio nulla, semel debet institui; neque verum innotescit, nisi ex constante repetitorum periculorum eventu. Plurima sunt aliena, quæ se in experimenta immiscent: discedunt ea in repetendo, ideo quia aliena sunt, et pura supersunt, quæ ideo perpetuo similiter eveniunt, quod ex ipsa rei natura fluant.

Anno 1736 Gottingam vocatus, Septemdecim in ea Academia annis vixi, non alibi moriturus, nisi infirma valetudo me in eum metum coniecisset, et vitam meam paucos post annos publice inutilem futuram, et certam ante diem mortem. Eo ergo loco legendo, et dissecando, plurimum profeci. Cadavera humana incidi fere trecenta et quinquaginta, viva animalia numerosiora, quam absque gloriæ suspitione enumerare fas sit. Quæ vidi, ea in adversaria sincerus in retuli.

Bernam redux, recuperata in patria valetudine, occasionibus vero cadaverum incidendorum exclusis, ad experimenta me converti, quæ sola in mea potestate supererant. Ergo vivis in animalibus cordis motum et respirationem; sed imprimis annis 1754, 1755, 1756, et 1757, sanguinis per pellucida animalium frigidorum vasa iter, et pulli salientis phenomena, et ossium in nascente ave formationem, plurimis experimentis persecutus, aliud tempus destino repetendis periculis, ad generationis historiam, et primordia nascentis animalis pertinentibus.

Humanum corpus omnino descripsi, in quo secundo tot annos trivi, ut ejus fabricam non unice videre licuerit, sed repetito videre, tantaque cum ubertate experimentorum, ut etiam, quid perpetuum, quid frequens, quid rarum sit, plerumque definire licuerit. Addidi rationes, dedi brutorum animalium analogias, et nonnunquam etiam ad minutiores fabricam iisdem sum usus, ut monerem tamen, hominemne describerem, an bestiam. Magis erim et magis disco, elementa corporis, et quidquid est subtilius, in diversis quadrupedibus omnino ejusdem esse fabricæ; majores vero et crassiores partes pro muneribus variare, quæ cuique generi animalium CREATOR præ-

cripserit.—*Elementa Physiologiæ Corporis Humani.*
 AUCTORE ALBERTO V. HALLER.—(*Tomus primus.*)

Quæ nemo vidit, exque mentis speculantis meditatione repetuntur, studui ut quam facillimo sermone proponerem, neque spem facerem majoris certitudinis, quam quidem præstiturus essem.

Lætus autem ad respirationem exponendam redeo, quæ et ab anatome declaretur, et a vivis animalium incisionibus, et a notissimis experimentis, quæ æris indolem declarant. Ad eum ergo laborem me transfero, ad quem DEUS ipse mihi otium concessit, qui in quietæ patriæ silentem recessum me duxit, ubi præter mea studia neque officia mihi fere superessent, neque voluptas ulla.—(*Tomus secundus.*)

Multos vides annos, LECTOR BENEVOLE, impensos legendis scriptoribus, incidendis cadaveribus, et vivorum animalium numerosissimis incisionibus. Non ideo velim spem Tuam promissis meis nimium augere. Multa fuerunt, quæ hominem veri cupidum, neque parcum laboris, tamen non siverunt, eam operis sui perfectionem adtingere, quam mente facile concepias.—(*Tomus sextus.*)

Lætus exitum video immensi operis : qui ab annis retro triginta et sex majorem vitæ meæ in id unum impendi. Numerosos libros eo fine legi, ut utilia ad id ipsum ornamenta decerperem : animalia pene innumera incidi, et mortua et imprimis viva, ut motus animales, eorumque causas perspicerem : hominum demum frequentia corpora per totos viginti annos dissecui, ut eam pulcherrimam fabricam cominus viderem. Video quam multa deficient. Longum id tempus non suffecit tamen, ut omnia ipse, et satis accurate, et satis repetito viderem : fuerunt quæ

numquam, fuerunt quæ non satis iterato viderim. Non placuit DIVINÆ PROVIDENTIÆ, quæ etiam humilium mortalium fata regit, perpetuitatem aliquam ejusdem studii mihi concedere: vocavit me ad alia subinde, et alienissima opera. Media inter officia magistratus, inter gubernandam non minimam, neque mihi facilem provinciam, loco ab omni humana anatome remoto, hoc ipsum opus præter quatuor primos libros, conscripsi: ita factum est; ut minora aliqua passim ab aliis, fideque mea dignis, scriptoribus mutuo sumere, ad majora amicos consulere necesse fuerit, quibus naturæ interrogandæ opportunitas esset.

Ego vero longo me absolvo labore, lætus si vita quærendo vero impensa seculo meo non inutilis fuit.—(*Tomus octavus.*)

I have not dared to insult the medical reader, or the scientific public, by translating the above passages,—not so much on account of the fact that, “translations bear the same relation to the original as the shadow to the substance, or as description in anatomy does to actual dissection;”^{*}—but because it is proper and *necessary* that the immortal author’s *own* words should descend to posterity. Nor will I apologise for transcribing these sentences, as I *may* have rendered some service to the *real* student of science, by withdrawing from the libraries of our Universities and learned societies at least a few of the emanations of a PHILOSOPHIC SPIRIT, whose words and works are only consulted by the *few*, albeit that the *name* of their author may be known by the *many*.

^{*} Rev. Thomas Chalmers, D.D., “Paley’s Evidences of Christianity.”

The venerable HALLER, then, forms one instance of the *how* and *by whom* improvements have been made in medical science.

Some of these sentences, however, have a still higher and nobler object in view. Their distinguished author not only loved science for its own sake, but it was the happiness of his life to assist his own pupils and friends, and to infuse into their bosoms that SPIRIT of investigation, and that LOVE for their profession, of which he himself was the STAR and ORNAMENT. A distinguished poet has said—

“Time destroyed
Is suicide, where more than blood is spilt.”

YOUNG.

Never was time better spent, more profitably devoted to any object, than considering the merits of HALLER. We will not pass *him* over so hurriedly, and we shall now pause for an instant to enquire what an eminent physiologist has written respecting him.*

“But the pupil of Boerhaave who made the greatest changes upon the system of his master, and perhaps the most important additions to the theory of medicine that have ever been made by a single individual, was HALLER, of whom it is difficult to say whether we ought to admire most the universality of his genius, his unremitting industry or the useful direction of his labours. ‘For the principal object of his studies,’ observes the eloquent and scientific Condorcet, ‘Haller made choice of physiology, that branch of medicine which, by penetrating into the intimate structure of the different parts of the body, endeavours to as-

* Dr. Thomson's Life of Dr. Cullen.

certain by what laws man is formed, is developed, grows, lives, reproduces his species, decays, and dies ; how each organ performs its appropriate motions, and fulfils the functions for which it is destined ; by what means the organs, which the exercise of their functions tends continually to destroy, may be repaired by nourishment and sleep ; by what mechanism a power, the principal of which is unknown to us, sometimes performs, at the command of the will, actions that are necessary for the preservation or for the happiness of man, and sometimes produces, independently of volition, operations that are essential to his existence ; how changes in the organs are sometimes the cause and sometimes the effect of derangement of the vital functions ; what the relations are which exist between the derangement of these functions, and the diseases of the parts that perform them ; and, finally, how remedies of every kind may, by acting upon these organs, re-establish order in the animal economy. Haller was aware that the science of physiology, long abandoned to the spirit of system, had become an object of distrust to natural philosophers, and it was with him a principal object to remove this prejudice. He hoped to render physiology a science as certain as any other physical science, a science by means of which philosophers might acquire a knowledge of the constitution of man, and physicians find a basis upon which to found their practice. For this purpose, it was necessary to establish the foundations of physiology upon the correct anatomy of man as well as upon comparative anatomy, which has so frequently revealed to us secrets respecting the animal economy, that the study of man himself had failed to discover. It was

necessary to banish from physiology, both that kind of metaphysics, which in all the sciences, has long concealed real ignorance under scientific terms, and those mathematical and chemical theories, rejected by mathematicians and chemists, and always employed with the greater confidence, and adopted with the greater respect, in proportion as teachers, or their disciples, have been ignorant of mathematics and chemistry. It was necessary to substitute, in place of all these systems, general facts, ascertained by observation and experience; to have the prudence to be satisfied with these facts, and to submit to remain ignorant of their causes; and to know that in all the sciences, there are limits beyond which it is doubtful whether the human mind can ever penetrate, and which it certainly can only pass by the aid of time, and a long series of labours.' By his exertions as an experimentalist, a teacher, and an author, Haller gave a most powerful impulse to the study and progress of physiology. His experimental researches on the formation of the chick *in ovo*, on the phenomena attending the growth of bone,—on the circulation of the blood,—and on the sensible and irritable parts of animals,—though forming but a small part of his labours, furnish a series of results unequalled in number, accuracy, and importance, by those of any other physiologist. But Haller's claims to the gratitude of posterity rest less perhaps upon the discoveries, valuable as they were, which he himself made in the animal economy, than upon that spirit for experimental physiological research which his example contributed so powerfully to engender, and to animate in his contemporaries and successors. His zeal and industry as a

teacher procured for him the warm and steady attachment of a numerous body of pupils, all eager to co-operate with him in his researches, to defend his opinions, and to extend his fame. By bringing together in his elements of physiology all that was known of this science,—by adding to the labours of his predecessors the results of his own observation and original experimental researches,—and by arranging the materials of this stupendous work upon a plan as strictly philosophical, as it was entirely new,—Haller has acquired to himself the title of father of physiology, a title by which, in the progress of discoveries, and amidst all the future changes of medical opinions, he must ever continue to be distinguished.”

I now proceed to say a few words of Mr. JOHN HUNTER, who, in the opinion of Mr. LAWRENCE, “was the greatest man in the combined character of physiologist and surgeon, that the whole annals of medicine can furnish.” I transcribe the following paragraphs.*

“Many parts of the human body being so complex, that their structure could not be understood, nor their uses ascertained, Mr. Hunter was led to examine similar parts in other animals, in which the structure was more simple, and more within the reach of investigation. This carried him into a wide field, and laid the foundation of his collection in comparative anatomy.

“In this new line of pursuit this active inquirer began with the more common animals, and preserved such parts

* Life of Mr. John Hunter by Sir Everard Home. I am aware that objections may be started against Home's account of our immortal author: I will transcribe nothing from his account upon which the slightest doubt can hinge.

as appeared by their analogy, or in some other way to elucidate the human economy. It was not his intention to make dissections of particular animals, but to institute an inquiry into the various organizations by which the functions of life are performed, that he might thereby acquire some knowledge of general principles. This, I believe, had never been before attempted, or certainly had never been carried far into execution.

“It was in this year (1767) that by an exertion in dancing, after the muscles of the leg were fatigued, he broke his tendo achillis. This accident, and the confinement in consequence of it, led him to pay attention to the subject of broken tendons, and to make a series of experiments to ascertain the mode of their union. He did not, according to the common practice, confine himself to his bed, but by compressing the muscles, and raising the heel, he was enabled, with the knee being kept straight, to walk about the third day after receiving the accident. He divided the tendo achillis of several dogs, by introducing a couching needle through the skin at some distance from it, and with the edge cut through the tendon; in this way the orifice in the skin healed up, and made it similar to a broken tendon. The dogs were killed at different periods to show the progress of union, which was exactly similar to that of a fractured bone when there is no wound in the skin.”

So much then for our brief inquiry “how such men as Haller and Hunter reasoned.”

CHAPTER II.

WE are now in a position to enter upon our proper subject. And the first question which arises is, what have we to do? We have to endeavour to support an argument, the negative of which is the position maintained by a large portion of the medical profession, and which is, without almost an exception, chimed in with by *public* opinion. An argument, which implies that we must employ *facts*, upon which we must *reason*.

Now, what are the most appropriate facts for our argument? We shall run little danger of committing an error in judgment by commencing with the BLOOD. For, what fluid of greater importance circulates through the human body?

I transcribe the following from Mr. John Hunter's work on the Blood:—

“These observations respecting apoplexy struck me much. I conceived at first, that the extravasations there

must consist of venal blood ; but, from reasoning, I could hardly allow myself to think so ; for whatever might be the beginning of the disease, it was impossible it could continue afterwards wholly venal, especially when the blood was found in a considerable quantity ; because, in many cases, great mischief was done to both systems of vessels, and the arteries once ruptured would give the greatest quantity of blood ; but to ascertain this with more certainty, I made the following experiment :—

“ I wounded the femoral artery of a puppy obliquely ; the opening in the skin was made at some distance from the artery, by a couching needle ; the blood that came from the small orifice in the skin was florid. The cellular membrane swelled up very much. About five minutes afterwards, I punctured the tumour, and the blood was fluid. In ten minutes I punctured it again ; the blood was thinner, and more serous, but still florid. In fifteen minutes I punctured it again. At first only serum issued ; but squeezing, a little blood came, but still florid ; the mass now seemed to be principally coagulated, which prevented further trials. Some days after, when I cut into the swelled part, I found the blood as dark as common venal blood ; so that here the change had taken place after coagulation.

* * * * *

“ As the blood is composed of different parts, it might be supposed, that if any particular part had been expended in any process, the remainder, as returned by the veins, would shew this by its different appearance or qualities. The only visible difference that I could perceive to take place, was in the appearance, or the quantity of

coagulating lymph. To ascertain this, however, I made the following experiments :—

“ I opened the right side of the thorax in a living dog, and tied a ligature round the vena-cava inferior, above the diaphragm ; I then applied my hand upon the opening, which allowed him to breathe, that the circulation might go on and fill the larger veins. When the inferior vena-cava became turgid, I killed him. On the day following I examined the blood in the different veins, and found a coagulum in the emulgent, mesenteric, vena-cava inferior, splenic, and in the venæ-cavæ hepaticæ, of sizes proportional to the sizes of the vessels ; nor was there any difference in any other way.

“ Experiment the second. Some blood was taken from the mesenteric vein of a living dog, and similar quantities from the splenic vein, the emulgent vein, and the vena-cava inferior, below the openings of the emulgents.

“ As all the experiments I had made upon the freezing of animals, with a view to see whether it was possible to restore the actions of life, when they were again thawed, were made upon whole animals ; and as I never saw life return by thawing, I wished to ascertain how far parts were, in this respect, similar to the whole ; especially since it was asserted, and with some authority, that parts of a man may be frozen, and may afterwards recover ; for this purpose I made the following experiments upon an animal of the same order with ourselves.

“ In January 1777, I mixed salt and ice, till the cold was about Zero : and on the side of the vessel containing them was a hole, through which I introduced the ear of a rabbit. To carry off the heat as fast as possible,

the ear was held between two flat pieces of iron, that sunk further into the mixture than the ear; the ear remained in the mixture nearly an hour, in which time the part projecting into the vessel became stiff; when taken out, and cut into, did not bleed; and a part being cut off by a pair of scissors, flew from between the blades like a hard chip. It soon after thawed, and began to bleed, and became very flaccid, so as to double upon itself, having lost its natural elasticity. When it had been out of the mixture nearly an hour, it became warm, and this warmth increased to a considerable degree; it also began to thicken, in consequence of inflammation; while the other ear continued of its usual temperature. On the day following, the frozen ear was still warm, and it retained its heat and thickness for many days after. About a week after this, the mixture in the vessel being the same as in the former experiment, I introduced both ears of the same rabbit through the hole, and froze them both; the round one, however, froze first, probably from its being colder at the beginning, and probably, too, from its powers not being so easily excited as those of the other; when withdrawn, they both soon thawed, and became warm; and the fresh ear thickened as the other had done before. These changes in the parts do not always so quickly take place; for on repeating these experiments on the ear of another rabbit, till it became as hard as a board, it was longer in thawing than in the former experiment; and much longer before it became warm; in about two hours, however, it became a little warm, and the following day it was very warm, and thickened. In the spring, 1776, I observed, that the cocks I had in the country had their combs

smooth with an even edge, and not so broad as formerly, appearing as if nearly one half of them cut off. Having inquired into the cause of this, my servant told me, that it had been common in that winter, during the hard frost. He observed, that the combs had become in part dead, and, at last, had dropt off; and, that the comb of one cock had dropped off entirely; this I did not see, as the cock by accident had burned himself to death. I naturally imputed this effect to the combs having been frozen in the time of the severe frost, and having consequently lost their life by this operation. I endeavoured to try the solidity of this reasoning by experiment. I attempted to freeze the comb of a very large young cock (being of a considerable breadth) but could only freeze the serrated edges (which processes were fully half an inch long); for the comb itself being very thick and warm, resisted the cold. The frozen parts became white and hard; and when I cut off a little bit, it did not bleed, neither did the animal show any signs of pain. I next introduced into the cold mixture one of the cock's wattles, which was very broad and thin; it froze very readily; and upon thawing both the frozen parts of the comb and wattle, they became warm, but were of a purple colour, having lost the transparency which remained in the other parts of the comb, and in the other wattle: the wound in the comb now bled freely: both comb and wattle recovered perfectly in about a month: the natural colour returned first, next to the sound parts, and increased gradually till the whole had acquired a healthy appearance. Finding that freezing both the solids and the blood did not destroy the life in either, nor the future actions depending on or-

ganization; and that it also did not prevent the blood from recovering its fluidity, I conceived the life of every part of the body to be similar: what will affect, therefore, the life of any one part, will affect, also, that of another, though probably not in an equal degree; for in these experiments the blood was under the same circumstances with the solids, and it retained its life; that is to say, when the solids and blood were frozen, and afterwards thawed, they were both capable of carrying on their functions."

The following question starts up upon reading the experiments just quoted, viz.—Was there no way in which Mr. Hunter could put his reasonings to the test, without having recourse to severe and protracted experiments upon living animals? This is the question. The most determined sceptic *must* answer this question in the negative. By what other mode of investigation could it be possible to ascertain the truth of Mr. Hunter's inquiry? Of what avail would all the dissections of the anatomist or pathologist have been in instituting this inquiry? None at all because the inquiry is one in which the *actions* of life are concerned, and which could only be solved by seeing the phenomena of life in action. If I freeze any part of an animal—which process implies that that particular part has been reduced to a torpid or inactive condition—is it possible to restore the actions of life of that particular part by thawing it? Plain common sense must answer, the only way in which you can ascertain this question is to freeze any part of a live animal and see the result.

Another question occurs—What practical advantage

was gained to science, and consequently to humanity, by inflicting these painful experiments? The above experiments were part of a suite undertaken to ascertain how far the blood is endowed with LIFE.

Upon this question hinged a most important law of the animal economy, the knowledge of which has led to the successful treatment of many diseases.

The vitality of the blood is still denied by several physiologists, among whom we may mention Thomson, Elliotson, Fletcher, Majendie, Milligan, and others; but as strenuously contended for by Sir C. Bell, Professor Alison, Prater, Thackrah, J. Hunter, Mayo, Grainger, Burrows, Albinus, Müller of Berlin, &c.* We do not presume, in this place, to give an opinion on so important a subject; but we will suppose the blood to be endowed with life, and the law to which we have just referred is, and which was arrived at through Mr. Hunter's experiments, viz., that we have it within our power to increase the function or action of any organ or part, or to diminish its action. Now, the knowledge that we possess a power over the phenomena of living matter is as important, and holds the same rank in animal life that the knowledge of the law of gravity does in inanimate matter.

This discovery of the vitality of the blood did not originate with Mr. Hunter, as appears from several passages transcribed by Mr. Palmer, from the writings of the immortal HARVEY; but as Palmer has justly observed, "We are unquestionably indebted to him (Hunter) for

* Experimental Essay on the Physiology of the Blood. By Charles Maitland, M.D., 1838.

its erection on a solid basis." I have ~~not~~ introduced Mr. Hunter's experiments, not because I myself doubted their propriety, or that I thought any one could be found who would say that they were unnecessary, but because it is necessary for the stability of my argument to show that not only have experiments been performed by the *heads* of our profession, but that they were *absolutely* and *imperatively* called for. It would equally serve the purposes of our argument to have selected any other of the experiments of Mr. Hunter. The question we have to consider is,—were Mr. Hunter's experiments necessary, and therefore justifiable, or were they not? It is not our province to expound physiological principles; all that we have to do is to select a few of the experiments of physiologists, and ask, are these detailed as facts: if they are, and we can prove them to be facts, we shall reason upon them, and build up and sustain our arguments on their foundation. I now proceed to consider the experiments of that distinguished philosopher and physiologist, Dr. WILSON PHILIP.*

Dr. Philip concludes his Preface with the following paragraph:—"From the commencement of the investigation, most of my experiments were made on the newly dead animal. In this, it will appear, there are other advantages besides saving the sufferings of the animal. What we call death, we shall find, is the ceasing of the sensorial functions, the whole of the vital functions, with the exception of respiration, remaining."

With the greatest deference and respect for the opi-

* Experimental Inquiry into the Laws of the Vital Functions. 1839.

nions of Dr. Philip, I cannot but observe that the following objection strikes at the root of the greater number of his experiments, viz., that of operating on the newly dead animal. It cannot but occur to the reflecting mind, that in operating on the newly dead animal we have not *all* the vital functions in operation, and we cannot, therefore, expect the same results that we would have in experimenting upon an animal endowed with all the powers of LIFE. We must remember that at least two of the most important functions of life are wanting in the newly dead animal, viz., the operations of mind, and its connection, and, therefore, influence upon the physical frame and the function of respiration. It is no argument to say that the circulation is independent of respiration, because what is called the *irritability* of the heart and arteries propels the blood through the capillaries for a longer or shorter period after the function of respiration has ceased. If the irritability of the heart and arteries be sufficient to carry on the circulation without respiration, what, then, is this power which is called irritability? and if it be capable of carrying on the circulation for an hour, a day, or a week, as we are assured that it is in various animals, of what use is respiration? *But* why does this supposed power cease at all? When we come to carry out this inquiry to its utmost bounds, we perceive not only an inconsistency—but more, an *inability* to explain the function of circulation upon irritability, because if it be capable of carrying on the circulation for *any period* of time, why is it not capable of performing the same for an indefinite period? We will take an illustration from Physics. We see a steam-boat in the

distance, ploughing the water at ten or more knots an hour; as she approaches the harbour her pace is slackened by gradually withdrawing the pressure of steam; as she enters the harbour, and before she arrives at the landing place, the power of steam is wholly removed: now, she does not stop at the instant that this power is withdrawn, but she moves onward at a slow rate and to a certain distance; what, then, is that agent which propelled her onward after her *proper* power had been taken away? The current of wind *may* have given her the *smallest* assistance, and but the smallest, because the current is interrupted and its power wholly expended on the innumerable objects by which she is surrounded. In one word, the universal law of attraction, from the influence of which no body in nature is free, by which our planet, and the many worlds in space are in constant although regulated motion, propel her forward, until she is met by a counteracting power—the force of resistance. But, our illustration also furnishes us with the operation, the *power* of force, or the *momentum* of moving bodies. To apply this illustration from inanimate matter to our proper subject, it would not be more absurd to call that power which propels the steam boat a certain distance after her proper power has been withdrawn, the *irritability* of her complicated machinery, than to say that the circulation in the newly-dead animal is carried on for a time by the irritability of the heart and arteries. Why the natural philosopher gives the proper explanation and therefore the legitimate term—law of attraction, is only because he is better acquainted with the laws of physics than the physiologist is with the laws of LIFE, or,

in other words, the laws which regulate the phenomena of ANIMATE CREATION. To say that the physical man is apart from and independent of his mental constitution ;— that the function of circulation can be carried on without the aid of respiration, in short, that the function of one organ has little if any connection with another, is to maintain that life and organization, which form the sum and substance, the alpha and omega of animate creation, do not act upon and mutually co-operate with each other. We can form no idea of life apart from organization, consequently, we must consider that the Deity willed that one part should assist and be influenced by the other.

Not to enlarge our remarks on the present topic, which will come to be considered more in detail as we proceed, we conclude by observing that only one advantage *can* be gained by experimenting upon the newly-dead animal, viz., saving the sufferings of the animal ; which advantage, we fear, is of very questionable propriety, as we cannot bring ourselves to think that any benefit is to be derived by avoiding the sufferings of animals. We may ask, why does not the operating surgeon stupify and place his patient almost on a par with the newly-dead animal by rendering him insensible to the “ stimulus of the knife” by administering powerful opiates, previous to the commencement of a painful and protracted operation ? The calls of humanity cry aloud for such assistance ; but it has been found that to obtund the sensibility of the nervous system by any such means is to sign the death warrant of the patient. What more striking illustration could be brought forward of the impropriety, nay, of the utter futility of experimenting on an animal, where one or more of the vital functions is destroyed ?

I select the following experiments from the very valuable work of Dr. Wilson Philip :—

“ The nervous power, whatever it be, is evidently conveyed by the nerves. If it be a vital power, its existence depends on the organization of the part in which it exists. Its propagation along the nerve, therefore, depends on the peculiar organization of the nerve, and cannot be performed by any other part. If the nervous power can be conveyed by other parts, it is not a vital power, but one that may reside in inorganized bodies.

“ With a view to determine this question, with the assistance of Dr. Hastings and Mr. Sheppard, I made many experiments on nerves directly proceeding from the spinal marrow, but could obtain no evidence of the nervous power having been conveyed by any part but the nerve itself.”

“ *Exp.* 79. The reader has seen, that removing a part of the eighth pair of nerves prevents the formation of the gastric juice, the fluid secreted in the stomach, which at length fails altogether, being no longer capable of acting on the food. At my request, Mr. Cutler divided, without otherwise disturbing, both of the eighth pair of nerves in the neck of a rabbit, which had been allowed, immediately before the operation, to eat as much as it chose after a fast of many hours. The divided ends of both nerves retracted, so as to cause a separation between them of at least a quarter of an inch on both sides. The animal died in about eight hours, and although the digestion was much deranged, such a change was found to have taken place on the food, as proved that part of the nervous power conveyed by the eighth pair of nerves had

reached the stomach. The result was such as left no doubt in the mind of any of those who witnessed it, among whom was Sir Benjamin Brodie.

“ M. Breschet, Dr. Milne Edwards, and M. Vavasseur, of Paris, have since repeated this experiment on a larger scale, and confirmed its result.”

All that I could say in support of, and to point out the necessity for the above painful and protracted experiment, and the many others which have been performed for the same object, cannot be better done than in Dr. Philips' own words:—

“ There is no better proof of arriving at truth, than that arguments drawn from dissimilar sources conspire in confirming the result of our inquiry.

“ Here a simple train of reasoning, unequivocal experiment, and every day's experience of the effects of stimulants on the muscular fibre, tells us that the nervous power is an agent of inanimate nature.”

“ Experiment 83. Two small dogs, of the same size and age, were kept without food for about thirteen hours; they were then permitted to eat as much lean raw mutton as they chose. In both, the eight pair of nerves were divided immediately after they had taken the mutton. In one of them the nerves were coated with tinfoil, as they had been in the rabbits, a three-shilling piece having been previously bound on the pit of the stomach and lower part of the thorax, after the hair had been shaved off; and voltaic electricity applied as in the foregoing experiments.

“ The dog which was not exposed to it was almost immediately affected with dyspnœa, and within ten minutes with repeated efforts to vomit. The other, to which it

was applied of sufficient strength to occasion a very gentle motion in the fore-legs, but not any expression of pain, breathed as free as before the division of the nerves, and never made any effort to vomit. Its application was twice discontinued for a few seconds, during which the animal breathed very laboriously, but on its re-application the breathing immediately became free. This dog lived two hours and a quarter.

“He (the reader) has seen that the experiment just referred to was repeated, and its result confirmed by M. Breschet, Dr. Milne, Edwards, and M. Vavasseur of Paris. These physiologists also repeated the other experiments related in this chapter on a scale much more extensive than was attempted in this country, and on a greater variety of animals. I consider myself much indebted to them for the ample confirmation they have afforded of the results just laid before the reader, and which will make any further repetition of the experiments unnecessary.”

These experiments, then, of our author's are sufficient.

To do our author common justice, we should quote all his experiments; this, however, would be to transcribe the half of his work, and would not be more impracticable than it would be unnecessary for our argument. We respectfully direct the attention of the enlightened public to Dr. Philip's work on the VITAL FUNCTIONS: we necessarily disagree with our distinguished author in some points,—these, we hope to be enabled to take up on a future and more fitting occasion.

In parting with our author for the present, we have only further to observe that the following query will sug-

gest itself to the unprejudiced and enquiring mind. "Were the experiments here detailed, and the many others performed by Dr. Philip and his friends, absolutely necessary for the cause of science, and consequently for the benefit of suffering humanity, because the object and grand end of all knowledge is the relief of man's mental and corporeal frame?" The candid mind has no alternative but to answer this question in the affirmative. He who would have the rashness, the hardihood, to reply otherwise, to *him* we would say:—"These are settled points, settled by every conclusion of the intellect, as well as by every tuition of the heart: stand aloof! disgrace not the name of science by throwing stones at the temple of truth."*

I make the following extracts from a "Further Report† on the subject of Poisons," by G. L. Roupell, M.D.

"The object of the author was to advance a step in showing the mode of operation of poisonous substances. The labours of Dr. Hodgkin and Dr. Roupell had hitherto been confined to the description and illustration of appearances resulting from the direct application of poisons to the mucous membranes. Dr. Roupell next proceeded to ascertain the effect which poisons produce when introduced into the circulation, and he concluded his paper with some conjectures suggested by the facts presented to him as to the probable origin of certain forms of disease."

The mode adopted in the experiments about to be detailed was to inject various agents into the veins; some

*Address by the Rev. W. Vernon Harcourt, before the British Association, held at Birmingham, 1839.

† To the meeting of the British Association. Held at Dublin in 1835.

actively and intrinsically poisonous; others poisonous only by their chemical relation to the circulating fluids. The substances employed were arsenic, corrosive sublimate, tartarized antimony, muriate of iron, acetate of lead, and kreosote."

"The results were common to the employment of all. First, a fatal termination from the administration of large doses of each; and secondly, a complete absence of all symptoms of derangement from the employment of smaller doses even of the most virulent."

"The paper was accompanied by several highly finished drawings; the first of which exhibited the œsophagus; the stomach, and part of the duodenum of a dog poisoned by the injection of arsenic into the veins. The œsophagus was natural in appearance. The stomach exhibited the hour-glass contraction, and contained about an ounce of toughish mucus. The tips of some of the rugæ were reddened at the contracted part, but it differed little from health at either extremity."

The mucous membrane of the small intestines was acutely inflamed, presenting narrow bands about two lines in breadth, of a bright red colour, extending transversely across the intestine, alternating with equal spaces of apparently sound membrane. This striped appearance was chiefly at the upper portion of the small intestines, the inflammation becoming more diffused in extent and diminishing in degree as it was traced downwards, and finally terminated at the extremity of this portion of the intestinal canal. The details of this experiment were as follow:—An ounce of a saturated solution of arsenic, made by boiling distilled water with an excess of arsen-

ious acid, and allowing it to cool, was thrown by means of a small syringe, at two o'clock p.m., into the femoral vein. For three minutes there was no obvious effect, but at the end of that time vomiting succeeded, and a quantity of half-digested food was thrown off the stomach. The respiration then became hurried and the animal appeared faint. In ten minutes there was great intestinal movement, the abdomen being frequently and forcibly drawn in. After twenty-five minutes vomiting was renewed, paralysis of the hind legs came on, and the animal died in sixty-five minutes. Examination was made on the next day. The limbs were rigid, the blood was fluid, the lungs were collapsed and had a rosy tint, but were not inflamed. The peritoneum was reddish. The appearances of the stomach and small intestines have been already described. The large intestines contained solid fœcal matter and were quite free from morbid alteration. There were no apparent changes in the mucous membrane of the trachæa or bronchi, none in the inner lining of the heart, veins, or arteries, none at least in their larger branches.

“The points of interest in this experiment are, first, the absence of inflammation in so many tissues with which the poison must have come in contact; secondly, its action on the mucous membrane alone; thirdly, the predilection shown for the mucous membrane of the small intestine, and, in this instance, the limitation of its action to that part of the alimentary canal, where it was intense, the membrane being covered with a layer of tough mucus mixed with blood; fourthly, a circumstance frequently observed in cases of poison, the rigidity of the limbs, the blood remaining fluid.”

For a detailed account of the other interesting and very important experiments performed by Dr. Roupell, the reader is referred to the transactions of the British Association, from which the above is transcribed.

I take the following from the "Report of the London Sub-Committee of the British Association, Medical Section, on the Motions and Sounds of the Heart." "The committee of members of the British Association resident in London who have been charged with the investigation of the motions and causes of the sounds of the heart, have held numerous meetings, and performed a considerable variety of experiments, on living and dead subjects, with a view to the ends of their appointment. They have also taken pains to inform themselves of the facts and reasonings published by preceding inquirers, and have submitted to the section the results at which they have arrived, together with such particulars of their experiments as they consider necessary to substantiate their conclusions."

Experiment 4. Subject, a young ass prepared as the last. Death twenty-six minutes after poisoning.

"At the roots of the great arteries the two sounds were distinctly heard, but after the introduction of two curved awls into the arteries (for the purpose of hooking up one lamina of each sigmoid valve) the second sound was wanting, the first being still distinct; on withdrawing the awls two sounds were heard, and soon after the heart ceased to act, twenty minutes after the death of the animal. At each systole while the heart acted vigorously, the ventricles felt to the finger as hard as cartilage. The heart being cut out and plunged in warm salt and

water, a light undulatory contractile motion pervaded the substance of the ventricles and columnæ carneæ and continued for some time. In this and every other observation the vermicular or undulatory motion supervened upon the cessation of the normal action of the organ, and never before the organ had ceased to act as a whole."

So much then (for the present, at least,) for our facts and authorities. I have adopted no arrangement in laying them down, nor am I sure that I have selected the best illustrations for my argument. But for the strict purposes of an argument, neither *system* nor quantity is required. To detail one experimental fact would be to build our argument upon as stable a foundation as were we to lay before our reader *all* the experiments which have been performed from the earliest period of the study of medicine to the present time. No other consideration would have induced us to transcribe the several experiments we have, but a desire to point out to the non-medical reader the manner and the purposes of performing experiments for the elucidation of scientific knowledge, which we could only do by various examples. We shall find it necessary to enumerate further experiments which will amply supply any deficiency, should any one consider us sparing in the facts we have already presented to his attention.

CHAPTER III.

WE have said that physiological science has exclusively to do with beings endowed with LIFE. We have defined LIFE to be the sum of the actions of organized beings; and we have seen that the changes which the *structure* or organs of organized beings are momentarily undergoing, are termed the phenomena and functions of the various organs of animated creation. With inanimate matter we have nothing whatever to do. Physiologists speak of the brain performing its functions, that is to say, that, from the healthy action of the brain, results the various processes of thought; of the stomach, and so of the functions, *i. e.* that the first process of the digestion of our food is carried on in the stomach, and so of the functions or actions of the other organs of our body.

We will briefly consider one or more of the experiments which have been performed to ascertain the precise changes which take place during the process of digestion.

Our feelings can never give us any indication of the changes which the food undergoes in the stomach, consequently, if we wish to know what process the food undergoes in the stomach, we must *see* the stomach in action, which we can only do by removing the parietes of the abdomen of an animal, and placing the stomach before the physical eye. The distinguished and indefatigable M. MAJENDIE has nobly expressed himself on this subject, and I offer no apology for laying his own words before my reader:—

“When still young, I was impelled by a kind of instinct to employ experiments for the discovery of truth, instead of blindly accepting every thing that was taught me in the form of assertion ; since then, my method has, I hope, rendered the science some service. Thus, for example, our teachers spoke of the contractions of the stomach as a phenomenon beyond all question, and regarded them as being as well established as all the contractions of your hand ; but I wanted evidence, and set about examining the changes which take place in the stomach during vomiting, and the manner in which that viscus acts. For this purpose, I laid bare the stomach in a living animal, by removing a portion of the abdominal parietes, and thus endeavoured to ascertain directly, whether it really contracted, as physiologists taught, or not. The error of believing the affirmative proposition was soon revealed to me. Instead of contracting under stimuli, and rejecting its contents, the stomach, on the contrary, dilated ; and hence the act of vomiting could not be attributed to any immediate contraction of the organ. The phenomenon just mentioned was repeated whenever the stomach of a living animal was laid bare ; and, in the impossibility of

refuting it, physiologists were henceforward compelled to abandon the hypothesis of active contraction, and adopt another explanation, founded on experiment, viz., that vomiting depends on the contents of the stomach being rejected by contraction of the abdominal muscles, and not by contraction of the stomach, as was before universally believed. You see that, without the aid of experiment, I should never have been able to rectify this point in physiology, and that the error would, in all probability, still continue to flourish, if my ideas had been confined to the doctrines inculcated in books, or delivered from the professorial chair. I might enumerate hundreds of errors which have been admitted equally into our best standard treatises, because their authors have never submitted to the test of experiment even a five-hundredth part of the facts which they cite; but I hasten to the principal point of the question which now occupies us, and shall confine myself for the present to the task of submitting to you a few of the objections which some people make to my experiments, and certain judgments that have been pronounced with little cognizance of the facts.”—M. Majendie’s Lectures, pp. 295, 296. See *Lancet* for 1836–7.

Can we sufficiently appreciate and admire the modesty, the candour, the love of knowledge, and the desire for TRUTH which breathe through every sentence of our author; yet, who has suffered more contumely! more scorn!! more hatred!!!

“ But the self-approving mind is its own light,
And life’s best warmth still radiates from the heart,
Where love sits brooding, and an honest purpose.”

We *feel* that we do not overstep the legitimate boundary

of JUSTICE, in replying to the “ thousand and one ” objections which have been started against MAJENDIE and his exertions in the cause of science, in the powerful yet simple language of PETRUS LOMBARDUS :—“ Est autem spes virtus, quâ spiritualia et æterna bona sperantur id est cum fiduciâ expectantur. Est enim spes certa expectatio futuræ beatitudinis, veniens ex dei gratiâ et ex meritis præcedentibus vel ipsam spem, quam naturâ præit charitas ut rem sperantam, id est beatitudinem æternam. Sine meritis enim aliquid sperare non spes, sed, præsumptio dici potest.”

Dr. Andrew Combe, in the preface of his very valuable work on the “ Physiology of Digestion ” has the following very appropriate remarks :—“ It may, at first sight, be doubted whether I have not exceeded proper bounds in thus dedicating a whole volume to the consideration of a single subject ; but the more we consider the real complication of the function of digestion,—the extensive influence which it exercises at every period of life over the whole of the bodily organization,—the degree to which its morbid derangements undermine health, happiness, and social usefulness, and especially the share which they have in the production of scrofulous and consumptive as well as of nervous and mental affections,—we shall become more and more convinced of the deep practical interest which attaches to a minute acquaintance with the laws by which it is regulated.”

I make the following extracts from Dr. BEAUMONT’S Work on the case of *Alexis St. Martin*, in whose stomach an artificial opening existed, through which the whole process of digestion in that organ could be seen.

“ In November, 1832, he again engaged himself to me for twelve months, for the express purpose of submitting to another series of experiments. * * *

During the whole of these periods, from the spring of 1824, to the present time, he has enjoyed *general* good health, and perhaps suffered much less predisposition to disease than is common to men of his age and circumstances in life. He has been active, athletic, and vigorous ; exercising, eating, and drinking, like other healthy and active people. For the last four months he has been unusually plethoric and robust, though constantly subjected to a continued series of experiments on the interior of the stomach ; allowing to be introduced or taken out at the aperture different kinds of food, drinks, elastic catheters, thermometer tubes, gastric juice, chyme, &c., almost daily, and sometimes hourly.

“ Such have been this man’s condition and circumstances for several years past ; and he now enjoys the most perfect health and constitutional soundness, with every function of the system in full force and vigour.”

I transcribe the following experiments :—

“ *Experiment 4.*—Aug. 8. At 9 o’clock A.M. I drew off an ounce and a half of gastric juice, into a three ounce vial ; suspended two pieces of *boiled chicken*, from the breast and back, into it, and placed it in the situation and temperature as in the second experiment ; observing the same regularity and minuteness.

“ Digestion commenced and progressed much the same as in the second experiment, but rather slower ; the *fowl* appearing to be more difficult of digestion than the *flesh*. The texture of the *chicken* being

closer than that of the *beef*, the gastric juice appeared not to insinuate itself into the interstices of the muscular fibre so readily as into the beef; but operated entirely upon the outer surface, dissolving it as a piece of gum arabic is dissolved in the mouth, until the particle was digested.

“The colour of the fluid, after digesting the chicken was of a greyish white, and more resembled a milky fluid than whey, and was the colour of the chyme from the beef.

“The contents of both vials, kept perfectly tight, remained free from any foetor, acidity, offensive smell or taste, from the time of the experiments (7th and 8th August) to the 6th of September; at which time, that containing the solution of *boiled beef* became very offensive and putrid; while that containing the chyme from the *boiled chicken* was perfectly bland and sweet. Both were kept in exactly similar situations.

“*These* (experiments) demonstrate, at least, that the stomach secretes a fluid which possesses *solvent* properties. The change in the solid substances is effected too rapidly to be accounted for on the principle of either maceration or putrefaction. I shall be able to show, in some of the following experiments, that aliment undergoes the same changes in the stomach as is effected in the mode here adopted.

“With a view to ascertain the variations of temperature, if any there were, in the interior of the stomach, under different circumstances and conditions of the system, and vicissitudes of the atmosphere, I instituted the following experiments.

Experiment 1.—December 6, 1829. At 9 o'clock A.M. I introduced the glass tube of a thermometer (Fahrenheit's) through the artificial opening into the stomach, in a healthy and empty condition, nearly the whole length of the stem. In six or eight minutes the mercury became stationary at ninety-four degrees. Weather cloudy, damp, and almost raining—ground wet, muddy, and thawing. Wind S. and mild. Thermometer, in a north exposure, sixty-three degrees. Commenced raining at eleven o'clock A.M., and continued all day, with oppressive atmosphere.

Experiment 2. Dec. 7. Introduced thermometer at the same hour as yesterday—circumstances of stomach the same. Mercury at ninety-eight degrees. Weather cloudy. Atmosphere damp. Wind N.W., and light. Thermometer twenty-seven degrees."

Other six experiments were performed for the same object.

Several experiments were performed to ascertain "whether the gastric juice be *accumulated* in the stomach, during periods of fasting, or even from the immediate and direct influence of hunger," and others "were instituted with the view of ascertaining the relative difference between *natural* and *artificial* digestion; to demonstrate the performance of digestion *out of the stomach*, by the gastric juice; and, also, the *continuation* of the natural process when *taken out* during the period of chymification."

The following are Dr. Beaumont's "INFERENCES, from the foregoing Experiments and Observations (which were upwards of 200.) 1. That *animal* and

farinaceous aliments are more easy of digestion than *vegetable*. 2. That the susceptibility of digestion does not, however, depend altogether upon *natural* or *chemical* distinctions. 3. That digestion is facilitated by *minuteness* of *division* and *tenderness* of *fibre*, and retarded by opposite qualities. 4. That the *ultimate principles* of aliment are always the same, from whatever food they may be obtained. 5. That the actions of the stomach, and its fluids are the same on *all kinds* of diet. 6. That the *digestibility* of aliment does not depend upon the quantity of nutrient principles that it contains. 7. That the quantity of food generally taken is more than the wants of the system require; and that such excess, if persevered in, generally produces not only functional aberration, but disease of the coats of the stomach. 8. That *bulk*, as well as *nutriment*, is necessary to the articles of diet. 9. That *oily* food is difficult of digestion, though it contains a large proportion of the nutrient principles. 10. That the *time* required for the digestion of food is various, depending upon the quantity and quality of the food, state of the stomach, &c.; but that the time ordinarily required for the disposal of a moderate meal of the fibrous parts of meat, with bread, &c., is from three to three and a half hours. 11. That *solid* food, of a certain texture, is easier of digestion than *fluid*. 12. That stimulating *condiments* are injurious to the healthy stomach. 13. That the use of *ardent spirits* always produces disease of the stomach, if persevered in. 14. That *hunger* is the effect of *distention* of the vessels that secrete the gastric juice. 15. That the process of *mastication*, *insalivation*, and *deglutition*, in an ab-

stract point of view, do not, in any way, affect the digestion of food : or, in other words, when food is introduced directly into the stomach, in a finely divided state, without these previous steps, it is as readily and as perfectly digested, as when they have been taken. 16. That *saliva* does not possess the properties of an alimentary solvent. 17. That the *first* stage of digestion is effected in the stomach. 18. That the natural *temperature* of the stomach is 100° Fahrenheit. 19. That the temperature is not *elevated* by the ingestion of food. 20. That *exercise elevates* the temperature ; and that *sleep or rest*, in a recumbent position, *depresses* it. 21. That the *agent* of chymification is the *gastric juice*. 22. That it acts as a *solvent* of food, and alters its properties. 23. That its action is facilitated by the *warmth* and *motions* of the stomach. 24. That it contains free *muratic acid* and some other active chemical principles. 25. That it is never found *free* in the gastric cavity ; but is always excited to discharge itself by the introduction of *food*, or other irritants. 26. That it is secreted from vessels distinct from the mucous follicles. 27. That it is seldom obtained pure, but is generally mixed with mucus, and sometimes with the saliva. When pure, it is capable of being kept for months, and perhaps for years. 28. That it *coagulates* albumen, and afterwards *dissolves* the *coagula*. 29. That it *checks* the progress of putrefaction. 30. That the pure gastric juice is fluid, *clear*, and *transparent*, without odour ; a little *salt*, and perceptibly *acid*. 31. That, like other chemical agents, it *commences* its action on food, as soon as it comes in *contact* with it. 32. That it is capable of com-

bining with a certain and fixed *quantity* of food, and when more aliment is presented for its action than it will dissolve, disturbance of the stomach, or "indigestion," will ensue. 33. That it becomes intimately *mixed* and *blended* with the ingesta in the stomach, by the motions of that organ. 34. That it is *invariably* the *same substance*, modified only by *admixture* with other fluids. 35. That *gentle exercise* facilitates the digestion of food. 36. That *bile* is not ordinarily found *in the stomach*, and is *not* commonly *necessary* for the digestion of food ; but 37. That, when oily food has been used, it assists its digestion. 38. That *chyme* is *homogeneous*, but variable in its *colour* and *consistence*. 39. That towards the *latter stages* of chymification, it becomes more *acid* and *stimulating*, and passes more rapidly from the stomach. 40. That *water*, *ardent spirits*, and most other *fluids* are not affected by the gastric juice, but pass from the stomach soon after they have been perceived. 41. That the *inner coat* of the stomach is of a pale, *pink colour*, varying in its hues according to its full or empty state. 42. That, in health, it is constantly sheathed with a *mucous* coat. 43. That the gastric juice and mucous are *dissimilar* in their *physical* and *chemical* properties. 44. That the appearance of the interior of the stomach, *in disease*, is essentially different from that of its *healthy* state. 45. That the motions of the stomach produce a constant *churning* of its contents, and *admixture* of food and gastric juice. 46. That these motions are in two directions ; *transversely* and *longitudinally*. 47. That the *expulsion* of the chyme is assisted by a *transverse band*, &c. 48. That *chyle* is

formed in the duodenum and small intestines, by the action of *bile* and *pancreatic juice* on the chyme. 49. That crude *chyle* is a *semi-transparent, whey-coloured* fluid. 50. That it is further changed by the action of the *lacteals* and *mesenteric glands*. This is only an *inference* from the other facts. It has not been the subject of experiment. 51. That *no other* fluid produces the same effect on food that gastric juice does; and that it is the *only solvent of aliment*."

We believe most persons have read the following case, which the illustrious HARVEY had the good fortune to see:—"A young nobleman had a portion of the parietes of the side destroyed by an abscess, consequent upon a fall. The wound healed, but without the restoration of the parts which had been destroyed by the abscess; and the heart and lungs could both be touched through the opening, without any feeling that they were touched. When he returned from his travels, the case became known to Charles I., who expressed a desire that Harvey might be allowed to see and examine him; and this was readily granted. "When I had paid my respects to this young nobleman," says Harvey, "and conveyed to him the King's request, he made no concealment, but exposed the left side of his breast, when I saw a cavity into which I could introduce my fingers and thumb; astonished with the novelty, again and again I explored the wound, and first marvelling at the extraordinary nature of the cure, I set about the examination of the heart. Taking it in one hand, and placing the finger of the other on the pulse of the wrist, I satisfied myself that it was indeed the heart which I grasped. I then brought him to the King, that

he might behold and touch so extraordinary a thing, and that he might perceive, as I did, that unless when we touched the outward skin, or when he saw our fingers in the cavity, this young nobleman knew not that we touched the heart ! ”

The above cases (than which we could not select two better calculated for our argument,) call forth the following remarks. Of the propriety of, and necessity for conducting Dr. Beaumont's experiments, it is sufficient to weigh impartially the important physiological deductions to which they have led, and the opinions which have been formed of them. I am hardly aware of one elementary physiological work which does* not discuss their merits and illustrate their principles.

Now, we will suppose that Dr. Beaumont had never met in with his patient, or, that an accident of the precise nature of the doctor's patient had never happened to any human being, but that he had exposed the stomach of an animal, and had performed upwards of two hundred experiments upon it, what is the opinion which would have been formed of Dr. Beaumont's sense of right and wrong, that is to say, of *his* treatment of the lower animals, and of the condition of his *moral* feeling ? In the one instance, the doctor's patient has a part of his stomach exposed by the accidental discharge of a musket ; in the other, the doctor *himself* exposes the stomach of an animal and performs the same experiments. In both

* “ I have derived the utmost advantage from a very valuable work by Dr. Beaumont,” * * * * “ Wherever they” (the objects he had in view) “ are known, they will be acknowledged to redound to his credit, not less as a man than as a philosopher.”—The Physiology of Digestion, by Andrew Combe, M.D., 1836.

instances, *pain* was the unavoidable result of exposing the stomach, although the performance of the experiments were not attended with pain. Beaumont's patient could inform the operator that his experiments occasioned him no inconvenience ; a dog could not ; consequently, the conclusion would, in all probability, have been, that the experiments upon the dog were attended with the most excruciating torture. In like manner, the nobleman could inform Dr. Harvey, that his heart could be handled without his being aware of it ; but not one of the lower animals could have told its operator that it felt pain upon the application of his hand to its heart.

The above experiments then lead to two important conclusions ; first, the absolute necessity of *seeing* the various organs of our body in action, as being the only means by which we can arrive at an *accurate* knowledge of the phenomena of life, or of the manner in which our complicated machinery performs its healthy functions. The second is, that we are not entitled to infer that physiological experiments invariably inflict pain upon the lower animals.

The late distinguished Sir CHAS. BELL has placed the question, so long disproved, beyond all doubt, viz., that the cutaneous tissue is the most abundantly supplied with nerves, and therefore creates the largest amount of pain upon the application of the knife. In amputating a limb, for instance, after that the skin has been cut through, the pain attendant on the dividing of muscles, and the use of the 'saw' is comparatively trifling.

No objections have been offered to Beaumont's expe-

riments, because they were attended with the happiest results ; but, most assuredly, the direct opposite would have been the case, had the same experiments been performed on the lower animals. If not, why have objections been raised against physiological experiments at all ? The grand question is, Are experiments upon the lower animals *necessary* ? If they *are* necessary, we shall have little difficulty in showing that they are *allowable*. To say that a thing is necessary to be performed, and yet, that we are not justified in performing it, is an argument no less extraordinary than absurd, indeed it actually contradicts itself ; notwithstanding, this *is* the argument maintained by those who object to physiological experiments, as we shall have occasion to shew ; and without wishing the slightest disrespect to the least self-opinionated of those who hold this doctrine, I must observe that, it offers one of the most remarkable instances of the processes of human thought with which I am acquainted.

But I proceed to detail a few experiments on the Nervous System.* Sir CHARLES BELL has the following very important sentence in the Preface of his work on the *Nervous System of the Human Body*. “ In the year 1821, he presented his first paper on the Nervous System to the Royal Society,—not that the opinions there expressed were new to him, but because he had

* These transcriptions from Sir C. Bell's work are misplaced. They should have come immediately after those of Mr. John Hunter. I had no alternative, solely owing to the difficulty which I experienced in procuring the book. No sooner is that valuable work placed on the shelves of our medical library than it is called for. I do not recollect to have had so much trouble with any other work. I hope this explanation will be deemed a sufficient apology. But I may here remark, once for all, that I set out with no arrangement in detailing the facts, but was guided by the facility of obtaining my authorities.—*Author*.

found them confirmed by experiments which could not be overlooked or thrown aside, if the rules of the Society were to be maintained."

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"It was necessary to know in the first place, whether the phenomena exhibited on injuring the separate roots of the spinal nerves corresponded with what was suggested by their anatomy. After refraining long, on account of the unpleasant nature of the operation, I at last opened the spinal canal of a rabbit, and cut the posterior roots of the nerves of the lower extremity; the creature still crawled, and there was no convulsion of the muscles of the back; but on touching the anterior fasciculus with the point of the knife, the muscles of the back were immediately convulsed. But I was deterred from repeating the experiment by the protracted cruelty of the dissection. I reflected, that an experiment would be satisfactory if done on an animal recently knocked down and insensible; that whilst I experimented on a living animal, there might be a trembling or action excited in the muscles by touching a sensitive nerve, which motion it would be difficult to distinguish from that produced more immediately through the influence of the motor nerves. A rabbit was struck behind the ear, so as to deprive it of sensibility by the concussion, and I then exposed the spinal marrow. On irritating the posterior roots of the nerve, I could perceive no motion consequent in any part of the muscular frame; but on irritating the anterior roots of the nerve, there was, at each touch of the forceps, a corresponding motion of the muscles to which the nerve was distributed. Every touch of the probe, or needle, on the threads of this root, was

attended with a muscular motion as distinct as the motion produced by touching the keys of a harpsichord. These experiments satisfied me that the different roots, and different columns from which those roots arose, were appropriated to distinct offices, and that the notions derived from anatomy were correct."

From which we plainly perceive that anatomical *structure* does sometimes suggest the correct uses of parts, but it is experiments which *prove* the truth or fallacy of our suggestions. Anatomy teaches the nature of structure ; Physiology the nature of function ;—Experimental Physiology is the only *experimentum crucis*.

"On finding this confirmation of the opinion that the anterior column of the spinal marrow and the anterior roots of the spinal nerves were for motion, the inference presented itself that the posterior column and posterior roots were for sensibility. But here a difficulty arose. An opinion prevailed that ganglions were intended to cut off sensation ; and every one of those nerves, which I supposed were the instruments of sensation, have ganglions on their roots.

"Some very decided experiment was necessary to overturn this dogma. I selected two nerves of the encephalon ; the fifth, which had a ganglion, and the seventh, which had no ganglion. On cutting across the nerve of the fifth pair on the face of an ass, it was found that the sensibility of the parts to which it was distributed was entirely destroyed. On cutting across the nerve of the seventh pair on the side of the face of an ass, the sensibility was not in the slightest degree diminished.

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“ But is the fifth nerve in other essential circumstances similar to the spinal nerves ? On recurring to the anatomy, and comparing the fifth nerve of the encephalon with a spinal nerve, the resemblance, both in man and brutes, was very remarkable. In the plates of this nerve we recognise corresponding parts in the spinal nerve and in the fifth nerve. In both nerves we see the double roots ; the anterior root passing the ganglion, and the posterior root falling into it or forming it. The most interesting piece of anatomy is to follow back the sensitive root of the fifth nerve, when we find it to be derived from the same tract of the spinal marrow with the sensitive roots of the spinal nerves.

“ Observing that there was a portion of the fifth nerve which did not enter the ganglion of that nerve, and being assured of this fact by the concurring testimony of anatomists, I conceived that the fifth nerve was, in fact, the uppermost nerve of the spine ; or, to speak more correctly, the most anterior of the double nerves common to man and animals, of those nerves which order the voluntary motions, and which at the same time bestow sensibility, in its extended sense, on the frame of the body.”

“ This opinion was confirmed by experiment. The nerve of the fifth pair was exposed at its root, in an ass, the moment the animal was killed ; and on irritating the nerve, the muscles of the jaw acted, and the jaw closed with a snap.* On dividing the root of the nerve in a living animal, the jaw fell relaxed. Thus its functions

*The experiment was made by the late Mr. John Shaw. Mr. Alexander Shaw's fingers were crushed by the closing of the teeth.

were no longer a matter of doubt: it was proved to be at once a muscular nerve, and a nerve of sensibility. And thus the opinion was confirmed, that the fifth nerve is to the head what the spinal nerves are to the other parts of the body, in respect to sensation and volition.

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“ These facts and experiments have been followed up by others to the satisfaction of all Europe, The opinion has been confirmed that the anterior roots of the spinal nerves bestow the power of muscular motion; and the posterior roots sensibility. When the anterior roots of the nerves of the leg are cut in experiment, the animal loses all power over the leg, although the limb still continues sensible. But if, on the other hand, the posterior roots be cut, the power of motion continues, although the sensibility is destroyed.”*—*Experiments on the nerves of the face, with a view to ascertain the uses of the Portio Dura.*

“ If an ass be thrown, and the *portio dura* be cut across where it emerges upon the face, before the ear, all the muscles of the face, except those of the jaws, will be paralysed. If its nostrils be confined for a few seconds, so as to make it pant and forcibly dilate the nostrils at each inspiration, and if the *portio dura* be now divided on one side of the head, the motion of the nostril of the same side will instantly cease, while the other nostril will continue to expand and contract in unison with the motions of the chest.

* “ Professor Tiedemann informed me that he had successfully repeated these experiments on the spinal nerves.”

“ On the division of this nerve, the animal will give no sign of pain ; or in no degree equal to what results from dividing the fifth nerve.

“ If an ass be tied and thrown, and the superior maxillary branch of the fifth nerve exposed, touching this nerve gives acute pain. When it is divided, no change takes place in the motion of the nostril ; the cartilages continue to expand regularly in time with the other parts which combine in the act of respiration ; but the sensibility is entirely lost. If the same branch of the fifth be divided on the opposite side, and the animal let loose, the parts will be deprived of sensibility, and he will not pick up his corn : the power of elevating and projecting the lip, as in gathering food, will appear to be lost. He will press the mouth against the ground, and at length lick the oats from the ground with his tongue. In my first experiments the loss of sensibility of the lips was so obvious, that it was thought a useless cruelty to cut the other branches of the fifth.”—*Some further remarks on the Diseases of the Nerves of the Face.*

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Were we to inquire no further, and to rest contented with the inference, that the two sets of nerves distributed to the face have distinct functions ; even this must prove useful both to the surgeon and physician. To the surgeon it must be useful in performing operations on the face, as well as in observing the symptoms of disease. If we have to plan an incision on the face, we must take especial care to avoid cutting the branches of the seventh nerve, for if it be divided, there will be paralysis of the muscles supplied by that nerve. Whereas, if we divide the fifth nerve,

though there may be more pain during the operation, and a defect of sensibility following it, no unseemly distortion will be produced. To produce paralysis as a consequence of an operation which was meant to remove deformity, is an unfortunate mistake ; but even worse consequences may result from an ignorance of the distinct nature of these nerves ; if, trusting to the eyelids being supplied by the branches of the fifth nerve, a surgeon, in opening an abscess or cutting out a tumour, should cut the division of the seventh, which goes to the eyelids, the consequence would be very unfortunate. The eyelids thenceforward would stand apart, the eye would be permanently uncovered and inflamed. From this inflammation the cornea becomes opaque, and the vision of the eye injured or altogether lost.

* * * *

“ To the physician the facts ascertained in this paper must also be important : he will be better able to distinguish between that paralysis which proceeds from the brain, and that partial affection of the muscles of the face, when, from a less alarming cause, they have lost the controlling influence of the respiratory nerve.” How often have I seen an inflamed gland affecting a branch of the *portio dura* mistaken for a disease in the brain itself, because it was not known that although the fifth nerve was free, the pressure on the seventh nerve was sufficient to paralyse the muscles of the side of the face. That the disease of the bone at one time affects the fifth nerve, producing excessive pain of the face without paralysis ; and that it, at another time, affects the seventh nerve, inducing paralysis without pain ; are now phenomena accounted for.”

* * * *

“ It was in the fervour of this zeal that he (Mr. Shaw) went to Paris and explained the arrangement by which I distinguished the nerves; and repeated my experiments with M. Majendie and others at Charenton, near Paris, in 1821.”

“ At this time an idea was thrown out that the fifth nerve was not for mastication, and that it was no more than the sensitive nerve of the face accidentally separated from the muscular nerve (the *portio dura*.) Perceiving that if this notion prevailed we should be thrown back into our former state of confusion, Mr. Shaw, in order to put the matter beyond all question, performed those experiments which are contained in this paper,—experiments which, in the gentleness of his nature, he would have hesitated to make from their severity, but for their being imperatively called for.”

We might multiply our illustrations, or, in other words, we might extend the basis upon which we wish to raise our superstructure, or argument, until we had occupied the whole boundary of *MEDICINE*, of which physiology forms no small part. We have already said that this is not necessary. We will, then, conclude this chapter by briefly observing, that, the extracts which we have made, we have advanced as facts, that is to say, we consider they were proper and necessary, and, therefore, imperatively called for.

PART II.



ON CRUELTY TO ANIMALS.

SERMON VIII.

“A righteous man regardeth the life of his beast.”

PROVERBS xii. 10.

By Thomas Chalmers, D.D. and L.L.D. Professor of Theology in the University of Edinburgh, and Corresponding Member of the Royal Institute of France.

“But the term science, so strangely applied as it has been in the example now quoted, reminds us of another variety in this most afflicting detail. Even in the purely academic walk we read or hear of the most appalling cruelties; and the interest of that philosophy wherewith they have been associated, has been pled in mitigation of them. And just as the moral debasement incurred by an act of theft is somewhat redeemed, if done by one of Science’s enamoured worshippers, when, overcome by the mere passion of connoisseurship, he puts forth his hand on some choice specimen of most tempting and irresistible peculiarity—even so has a like indulgence been extended to certain perpetrators of stoutest and most resolved cruelty; and that just because of the halo wherewith the glories of intellect and of proud discovery have enshrined them.”

THE venerable writer of the above sentences has most unaccountably misunderstood the real objects for which Experiments on Living Animals are at any time perform-

ed, and consequently has strangely misapplied his language in his strictures on Experimental Physiology.

The term Science means KNOWLEDGE of Animate and Inanimate matter ;—we have been furnished with *faculties* to acquire *knowledge*, to retain it, and to make a proper use of it ;—not only so, but the Deity has willed and *ordered* us to make the best use of our faculties for the ends of 'TRUTH and JUSTICE, and for the INTERESTS and WELL-BEING of our fellow men. If the *acquisition* of knowledge, and its many *applications*, were the grand ends for which Man was created ; if the lower animals were placed in this world for the *use* of man, and if philosophy can be advanced by treating the inferior animals *in any way*, for the *purposes* of philosophy, it follows that, whatsoever be the extent of *pain* to which they are subjected, that that *pain* is a *lesser evil* to *effect a decided good* ; that it was wisely ordered ; and that *we* are authorized to inflict it for the attainment of knowledge and the benefits of suffering humanity. The question is : Is knowledge to be subservient to the lower animals, or the lower animals to it ? Surely no one could be found who would so far *forget* himself as say that knowledge must be subservient to the lower animals ; that is to say, that we must rather remain in ignorance than that we should inflict pain on creatures *placed within our power*, to enable us to substitute the *light* of knowledge for the *darkness* of ignorance ; consequently, the logical and *common sense* view of the question is that we are entitled to inflict pain for the interests of science. The expression “*appalling cruelties*,” then, cannot find a place ; there can be no such thing as cruelty in the abstract ; it is a mis-

nomer, and does not apply to our proper subject. I hardly know how to find a loop-hole from censure for the very reverend author when he speaks of "certain perpetrators of stoutest and most resolved cruelties," which, of course, he applies to those who perform experiments upon living animals. "We are amused with the reveries of Stahl, but for instruction we look to the experiments of Haller. And to similar experiments we must look for all the information we can obtain on the subject."* We fear the following true but *severe* remark, has some application in the present instance:—

Il faut dire, les physiologistes ne sont pas assez philosophes, et les philosophes ne sont pas assez physiologistes.†

We have only to consult the writings of the cultivators of physiological science to be satisfied that they had a far higher and *nobler* object in view than "the halo wherewith the glories of intellect and of proud discovery have enshrined them." Let us hear ADELON'S opinion of the science, for the advancement of which we are contending:—Le sujet (Physiologie De L'Homme) qu'il embrasse est immense, sans doute : l'homme est il premier des êtres vivans ; nul ne possède un aussi grand nombre de facultés, n'offre, dans sa structure, autant d'organes ; dans aucun, la vie ne se compose d'autant de phénomènes, et ne présente un mécanisme aussi compliqué ; pour en tracer une exposition claire, il faut, sans cesse, en appeler à la physiologie des autres animaux, et recourir à des notions

* An Experimental Inquiry into the Laws of the Vital Functions, by A. P. W. Philip, M.D., F.R.S.E.

† Hallé, *Cours d'Hygiène*, an. xi.

empruntées à toutes les autres sciences naturelles. And the no less eloquent BICHAT has said : En donnant l'existence à chaque corps, la nature lui imprima donc un certain nombre de propriétés qui le caractérisent spécialement, et en vertu desquelles il concourt, à sa manière, à tous les phénomènes qui se développent, se succèdent et s'enchainent sans cesse dans l'univers. Jetes les yeux sur ce qui vous entoure ; portez-les sur les objets les plus éloignés ; qu'aidés du télescope ils parcourent les corps qui nagent dans l'espace, ou qu'armés du microscope ils pénètrent dans le monde de ceux que leur petitesse sembloit devoir nous dérober toujours : partout vous trouverez d'une part les propriétés physiques, de l'autre les propriétés vitales mises en action ; par tout vous verrez les corps inertes graver les uns sur les autres et s'attirer, les corps vivans graver aussi, mais de plus sentir et éprouver un mouvement qu'ils ne doivent qu'à eux.

"The noise of worldly fame is but a blast of wind,
That blows from diverse points, and shifts its name,
Shifting the point it blows from. Shalt thou more
Live in the mouths of mankind, if thy flesh
Part shrivel'd from thee, than if thou hadst died
Before the coral and the pap were left ;
Or e'er some thousand years have past ? and that
Is, to eternity compar'd, a space
Briefer than, is the twinkling of an eye
To the heaven's slowest orb !" — DANTE.

We feel we do not require to add more to shew how unjust and unhappy this last sentence of our author is.

Dr. Chalmers continues :—

"And thus it is, that bent on the scrutiny of nature's laws, there are some of our race who have hardihood enough to explore and elicit them at the expense of dreadest sufferings—who can make some quaking, some

quivering animal, the subject of their hapless experiment—who can institute a questionnaire process by which to draw out the secrets of its constitution, and like inquisitors of old, extract every reply by an instrument of torture—who can probe their unfaltering way among the vitalities of a system which shrinks, and palpitates, and gives forth, at every movement of their steadfast hand, the pulsations of deepest agony; and all, perhaps, to ascertain and to classify the phenomena of sensation, or to measure the tenacity of animal life, by the power and exquisiteness of animal endurance. And still, it is not because of all this wretchedness, but in spite of it, that they pursue their barbarous occupation. Even here it is possible, that there is nought so absolutely satanic as delight in those sufferings of which they themselves are the inflictors.”

These passages afford us a very striking and *instructive* example of what a philosopher *can* write; whose mode of expression sufficiently implies how very imperfectly he is acquainted with the functions and laws of his own corporeal frame. The vivid description of pain, of torture, of cruelty, which these sentences convey is a thousand times more visionary than real. To these objections it is sufficient to state, that experiments are neither daily nor weekly performed by those who most frequently resort to them, and to whom science and humanity are under the deepest obligations for the *light* they have thrown on the practice of medicine and surgery. In all my research (and I have looked over several thousand volumes) into the wide BOOK OF KNOWLEDGE, I can nowhere accuse any experimentalist directly of performing experiments for the mere sake of performing them. I can

imagine no man in his sound senses to be guilty of so palpable an absurdity, not to speak of the total perversion of *moral* feeling which would attach to the act. From what we know of the processes of the human mind, we have every reason to believe that the least educated man—the worst moral character, never performs an act without thinking upon and having a motive in performing it; and certainly, we have as little reason to suppose that a man of science would inflict pain on any animal, without having a distinct and most satisfactory reason for so doing.

Experiments are *occasionally* demanded, and then, and only then, are they performed.

Besides, many of the experiments now performed, notwithstanding they are of the most important nature, and attended, *apparently*, with the greatest suffering, yet, carry with them, not the slightest amount of pain, the animal, in many instances, having previously been rendered insensible, so that, when we come to consider the matter in an impartial manner, aided by a proper knowledge of what the phenomena of life consist, or in what manner each organ of our body performs its assigned functions, we cannot but think that there has been a great deal of unnecessary and unfounded alarm, and that much of *Time* and *Eloquence* have been expended on a subject which had better been left in the hands of those whose profession and business it can alone concern—

“ You’re ever building, building to the clouds,
Still building higher, and still higher building,
And ne’er reflect, that the poor narrow basis
Cannot sustain the giddy tottering column.”

W ALLENSTEIN.

Again: Is it of no importance "to ascertain and to classify the phenomena of sensation?" Dr. LIEBIG has the following very concise and appropriate paragraph:—

"Nature speaks to us in a peculiar language, in the language of phenomena; she answers at all times the questions which are put to her; and such questions are experiments. An experiment is the expression of a thought; we are near the truth when the phenomena, elicited by the experiment, correspond to the thought; while the opposite result shows that the question was falsely stated, and that the conception was erroneous."*

Surely, we have already said sufficient to disprove the negative position of our author.

There are other arguments by the Rev. Dr. Chalmers which we must consider, because it is our duty to refute them; these will be more appropriately introduced under another head of our subject.

Our next Book is "The Animal Creation: its Claims^s on our Humanity stated and enforced. By the Rev. John Styles, D.D., 1839." "The Committee of the Society for the Prevention of Cruelty to Animals" awarded £100 for this Essay, which is dedicated to Her Majesty the Queen.

"The public in general, probably, have no conception of the extent and variety of the cruelties of vivisection; the statements that occasionally force their way into the newspapers being comparatively few."

We have only to ask what favour, or justice, on scientific grounds, we can expect from a writer, who, in one

* Organic Chemistry, p.37, (translation.)

sentence, would taint the very atmosphere, by the *breath* of discontent and insinuation !

“ In a journal that poured forth its ridicule against Mr. Martin, on account of his benevolent, though somewhat eccentric exertions in the cause of humanity to animals, it is admitted, that a large portion of the researches into comparative anatomy are extremely cruel ; and every surgeon’s apprentice thinks himself entitled to find his way into the arcana of nature by scalping cats and rabbits to see where their brains lie. The transactions of the College of the medical craft in this sense would convict them before a convocation of Ashantees.” Now, the candid reader will inquire whether Dr. Styles has given any *proof* for what he has advanced ; or whether what has just been transcribed is not an unfounded assertion ? Dr. Styles has given no proof ! The result of my knowledge most unequivocally disproves and nullifies the above sentences. I was a pupil in the Extra-Academical School of Medicine in this city four years, after which I passed four years of study in the University, during which period I cannot adduce a single instance where experiments on living animals, were unnecessarily or cruelly performed. During all that time, and up to the present moment, I have had the most frequent intercourse with most, if not all the most distinguished students of the University, many of whom I am proud to rank amongst my best friends. I have visited all our Northern Universities, and of them I can as confidently speak as of the University of Edinburgh. The question then comes to be whether is it more probable that the Rev. Dr. Styles is in error, or the author ? This

calls for an explanation, and until an explanation be made, supported by facts, we are in no wise entitled to consider what Dr. Styles has adduced in any other light than that of assertions. I will now give a few instances, of pupils of the University who have cultivated Experimental Physiology; who have received the highest honours, and who now hold a conspicuous position in the scientific world."

I transcribe the following very important paragraph from Dr. A. P. W. Philip's Inquiry into the Nature of Sleep:—

"If the attempt to free some parts of this science from the confusion in which it has been involved, should expose me to the charge of presumption, because it can only be done by judging the labours of others, I have at least the apology of the necessity of the task and of not a short life, in a great degree devoted to the subject; for although it is not more than twenty years since I commenced the investigation, the progress of which the Society did me the honour to report, my experiments on subjects immediately connected with that inquiry were commenced within a couple of years after I had begun the study of medicine, and have with intervals been continued ever since."

An Experimental Essay on the Relative Physiological and Medicinal Properties of Iodine and its Compounds; being the Harveian Prize Dissertation for 1837. By Charles Cogswell, A.B., M.D., etc.

Previous to the appearance of this valuable monograph, what little was known of the Medicinal and Physiological action of Iodine was not more vague and un-

satisfactory, than were the multiplicity of resources to which it was necessary to refer to collect that knowledge. Dr. Cogswell's Essay is a connected and valuable summary of what was previously known of Iodine, to which he has added many new and important facts, the result of the number and originality of his experiments. These remarks are equally applicable to all the works in the present chapter.

A Treatise on the Chemical, Medicinal, and Physiological Properties of Creosote, Illustrated by Experiments on the Lower Animals: being the Harveian Prize Dissertation for 1836. By John Rose Cormack, M.D., now a Fellow of the Royal College of Physicians, and Editor of the "Edinburgh Monthly Journal of Medical Science." The value of this work is sufficiently attested by the very high opinions from the public press.

By the same talented Experimentalist "Prize Thesis. Inaugural Dissertation on the Presence of Air in the Organs of Circulation," 1837.

"Inaugural Dissertation on the Physiology and Pathology of the Brain. By John Hughes Bennett, M.D., etc, 1837."

"Prize Thesis. An Experimental Inquiry into the Physiology of Cutaneous Absorption, and its application to Therapeutics. By William Harries Madden, M.D.," etc, 1838.

"An Experimental Inquiry into the Physiological Actions, the Poisonous Properties, and the Therapeutic effects of the Hydrocyanic Acid. By Henry Lonsdale, M.D., now Lecturer on Anatomy, Queen's College, Edinburgh."*

* See Edin. Med. and Surg. Jour. Jan. 1, 1839.

“Prize Thesis. An Experimental Inquiry, concerning the Presence of Alcohol in the Ventricles of the Brain after Poisoning by that liquid: together with Experiments illustrative of the Physiological Action of Alcohol. By John Percy, M.D., 1839,” now the able Lecturer on ORGANIC CHEMISTRY in the Birmingham Royal School of Medicine.

My talented friend, Dr. Samuel Wright, is the author of the following Papers on Experimental Physiology:—
 1. An Experimental Essay on the Physiological Action of Ergot of Rye; for which the Harveian Society of Edinburgh awarded its annual Prize; 2. An Experimental Essay on the Physiological Action of the Poisonous Gases, for which the Harveian Society again awarded a Prize; 3. An Experimental Essay on the Physiological Action of Tobacco, which received the Maclaren Gold Medal of Aberdeen; 4. An Experimental Essay on the Vitality of the Blood, to which was awarded the Prize of the Hunterian Medical Society of Edinburgh; 5. An Experimental Essay on Asphyxia from Submersion, for which the distinguished author received Professor Traill’s Gold Medal; 6. His Thesis, experimentally illustrative of the Physiological Action of Mercury and its Chlorides;* and 7. Experimental Ob-

* “Principal Lee, in neat addresses, delivered to each of the gentlemen mentioned above, Messrs. Samuel Wright, John James Wright, Frederick Forbes, and W. O. Markham, the superb gold medals awarded by the faculty. It was stated that the medals were all of equal value, but that the Senate wished particularly to distinguish the Essay of Dr. Samuel Wright, which was not only superior to any given in this season, but to any Essay ever presented to the faculty. The Essay set at rest many disputed questions in reference to the physiological action and therapeutical application of mercury and its most important salts, the chloride and bichloride, which have hitherto been but imperfectly understood, and will be hailed by all physicians and toxicologists as a text-book, in reference to the subjects on which it treats.”—Report of the Graduations in the Scottish Standard for Wednesday, August 5, 1840.

servations on the Pathology of the Saliva, and on the characteristics of Expecterated Matter;* on Salivary Calculi; and on Animal Gases.

Our object is not to furnish a *list* of all the "surgeon's apprentices," or medical students, who have experimented upon living animals, but to give a few *illustrations*; consequently, we have purposely omitted several other youthful experimentalists.

So much then for the *truth* of what has been advanced, that, "every surgeon's apprentice thinks himself entitled to find his way into the arcana of nature by scalping cats and rabbits to see where their brains lie."

CONDILLAC has the following very appropriate paragraph:—

L'imagination a sur-tout les agrèmens en vue; mais elle n'est pas opposée à la vérité. Toutes les fictions sont bonnes, lorsqu'elles sont dans l'analogie de la nature, de nos connoissances ou des nos préjugés. Mais, dès qu'elle s'en écarte, elle n'enfante plus que des idées monstreuses et extravagantes. C'est là, je crois, ce qui rend cette pensée de Despréaux si juste.

"Rien n'est beau que le vrai; le vrai seul est aimable.
Il doit régner par-tout, et même dans la fable."

Dr. Styles continues:—"A French professor, a year

* "This Essay was written for the Harveian Prize of last year, and was returned to me with the following extract from the minutes of the Society:—'That Mr. Wright's Essay be returned to him, with the Council's marked approbation of the talent and industry displayed in it; and at the same time with an expression of their regret, that his premature avowal of the authorship being against the regulations of the Society, they could not award him the prize.'"—Extracted from Dr. Wright's Testimonials, when Candidate for the Chair of Pathological Anatomy and Clinical Medicine in University College, London.

or two since, fastened a dog to his surgical table by driving nails through his feet ; and when he heard from afar the execrations of the English press, the exonerating answer was, that, ‘ the same hammer which had fastened his feet knocked him on the head,’ that is, he tortured him for his pleasure ; and when he grew tired of the amusement, he coolly dispatched him out of his misery.”

So much has been said against this distinguished man which, in the course of things, never could happen, that I cannot but express my doubt of the truth of the statement before us. That we may be argumentative, we will suppose that Majendie did inflict the cruelty, which has been laid to his charge ; is this any reason why we should keep from him that respect and homage which is his due ? As well might we despise and set at nought the efforts of NATURE, because, occasionally, she deviates from her usual tract, and presents to the world a human monster, born of a woman—born under the law ! Do we accuse Nature of having tortured a mother, a father, a family, because a being has been born unto them, which, if it have life, can only survive a few hours, or a day or two ! The argument is strictly parallel. No more are we entitled to revile and treat Majendie as the veriest monster on the face of the earth, because, on an occasion, he has done that, which he should not have done, and there is no help in him. I beg to refer the candid reader to the Appendix (4), where I have placed under one head, an amount of genius, and industry, which, whatsoever may be said to the contrary, places Majendie *high* in the list of those who have forwarded the interests of Science, and alleviated “ the many ills that flesh is heir to.”

"Go on, O friend ! explore with eagle eye ;
 Where wrapp'd in clouds retiring causes lie :
 Trace their slight bands, their secret haunts betray,
 And give new wonders to the beam of day ;
 Till, link by link, with step aspiring trod,
 You climb from Nature to the throne of God."

Lines to Erasmus Darwin, M.D., F.R.S.

"In this country many thousands of animals of all descriptions, from the worn-out horses and asses regularly bought for the purpose, to the most minute insect, are dissected alive, and subjected to experiments which include every sort of cruelty that the scientific and unscientific practitioner can invent."

It is very strange that our author, *a divine*, should better know what is going on in the medical profession than the members of that profession *themselves* know. One would think he were a *cock robin*, here, there, and everywhere,—that he saw everything, yet, in truth, saw nothing, for the very obvious reason, that only nothing had any existence. Unless a *census* were to be taken, it is impossible to form any computation of the amount of experiments annually performed, consequently, Dr. Styles would have been as near the truth if for thousands he had substituted millions, billions, and upwards. To be serious, we believe hundreds should stand in the place of thousands ; we doubt much if a thousand experiments on living animals are (on an average) annually performed in the whole of Her Majesty's dominions. HIPPOCRATES "compares the human body to a circle ;"* the Efforts of Science, as

* "No part can be called the beginning nor end : this reasoning he applies to diseases, where the derangement of one function involves many others in disorder."—Dr. W. Black's Historical Sketch of Medicine and Surgery.

well as the Fluctuations of Commerce all observe this tendency ; in one word, it is the Law of Attraction operating on everything in the Universe. Science and Commerce observe the law of tides—they ebb and flow ; they may make as much advance in one year as what they have the twenty previous, and vice versa.

“ They saw off portions of the skulls of living animals ; they pare away the brain in slices ; they starve them to death ; they tie up the bile duct, the thoracic duct, the pylorus ; they lay bare the heart ; they divide the nerves ; they cut away viscera ; they apply hot irons to the brain ; they kill them with poisons, and in short, multiply their modes of torture without end, to gratify *curiosity*, for no higher end can most of them ever answer.”

If Dr. Styles possessed that superficial knowledge of physiology which is called the “ outlines ” of a science, he would not have written the above sentence. I have already said that *no pain* is occasioned by the surgeon’s saw in the process of amputating a limb, nor is any pain occasioned in sawing off portions of the skulls of living animals, of which there are a few instances on record, but in which the operators had a definite and laudable object in view ; it is only when bone is *inflamed* in the process of disease that it possesses sensibility ; nor is pain a consequence from paring away the brain in slices ; the surgeon frequently has recourse to this operation in hospital practice ; animals have *occasionally* been starved to death, but I doubt very much if as many instances can be furnished from the lower animals, as are yearly presented in the human subject in our populous towns. More than one such instance has occurred to my own

observation. About a year ago I attended to the request of the friends of a poor woman from the Grassmarket Dispensary, (about the most thickly populated district by the poor in Edinburgh,) who was represented to be "very ill." I immediately visited the poor woman, who resided in one of those "dens of poverty," closely adjoining which a murder had been perpetrated a short time before. It was a square building, (a kind of out-house), about ten feet by eight, the roof of which was so imperfect, that I had only to cast my eyes upwards to behold the vaulted heaven ; my stay was during a heavy shower of rain, and I and my patient received a goodly portion of it. The woman sat upon a little straw in a corner, with scarce sufficient rags to cover her nakedness. I soon found that the poor creature was not ill in the common acceptation of the term, but that the powers of nature were rapidly being expended from want of the common necessaries of life. Her expression of countenance struck me exceedingly. My eyes traced the origin, course, and insertion of every muscle on her face, and did not more recal to my recollection the ghost in Hamlet, than did her whole physical frame remind me of the following distich in WALLENSTEIN :—

" An ignominious monument
It is the soul that builds itself a body."

The bile duct, the thoracic duct, and the pylorus, have been tied in the lower animals. " They lay bare the heart ;" (see " Report of the London Sub-Committee of the British Association, Medical Section, on the Motions and Sounds of the Heart.") " They divide nerves ;" (see

Experiments by Bell, Müller, Majendie, Tiedemann, Mayo, ~~Fleuens~~, and a long list of others.) “They cut away viscera;” *portions* of the viscera have been cut away, and the surgeon is sometimes called upon to perform the same operation on the human subject. Sir A. COOPER, in his Lectures on Surgery, recommends his pupils to cut open the abdomen of live animals, in order to study the phenomena of the peristaltic and vermicular motions of the bowels, as being the only means by which the many and important functions of that complicated viscus can be properly understood. “They apply hot irons to the brain;” this is a vulgarism; surgeons apply the *actual cautery* to the mouths of bleeding vessels in all parts of the body, when dissolution is impending, from the drain of the vital powers of the system. “They kill them with poisons;” (see ORFILA, CHRISTISON, MAJENDIE, MORGAN, ADDISON, SAMUEL WRIGHT, and all Toxicologists,) “and in short multiply their modes of torture without end, to gratify *curiosity*, for no higher end can most of them ever answer.” The facts and reasonings we have advanced sufficiently refute this sweeping and unphilosophical conclusion of our author.

I now take up a “Prize Essay on Cruelty to Animals, by James Macaulay, M.A., M.D.”

“The last class of sufferings which I propose to consider, are those inflicted with a view to the promotion of science, and the consequent advantage of mankind. I know well, that any opposition to the practices referred to, is liable to be at once ascribed to ignorance and bigotry; and that a false and sickly sensibility may be said to usurp the place of true and rational feeling. But we

are not to permit the mere name of science to deter us from protesting against evils by which we conceive that true science is disgraced; nor allow, that the respect always due to its flag, is to be construed into a license and immunity for every injustice or atrocity that may be committed under it."

Dr. Macaulay transcribes the opinion of Dr. JOHNSON, in one of the papers in the *Idler*, upon which he makes the following remarks:—"I admit that Dr. Johnson has been prompted by his just indignation to too indiscriminate an attack, and that he has misrepresented the motives of physiologists. But his statement is right in the main; and although, of course, ascribed to bigotry and prejudice by those against whose cruelty it is directed, and who are ashamed of his honest censure, it displays the general aspect in which the question ought to be regarded. For, even though the fullest admission were made of the abstract propriety of operations on living animals, we hold that their utility for scientific purposes has been greatly exaggerated; that the amount of knowledge acquired through them has been very limited; and that few discoveries have been made by such means, by which the treatment of disease has been improved, or the power of alleviating human suffering increased."

"Before stating my opinion on these points, it may be well, in order to guard against misconception, to mention the description of experiments to which my remarks are applicable. I have read of an eminent physiologist who, in order to illustrate the violence of the natural love of parents towards their offspring, opened a bitch, and as she lay in the most exquisite tortures, offered to her one

of her young puppies, which she immediately fell a licking, and for the time seemed insensible of her own pain. On removing it, she followed it with her eyes, and began a wailing sort of a cry, which seemed rather to proceed from the loss of her young than the sense of her own torment.* Few, I presume, would, in the present day, in this country at least, justify, far less practise, such cold-blooded cruelty as this. If such there be, they hold the one extreme of opinion upon the present question. With regard to the other extreme, Dr. Wilson Philip, one of the few respectable physiologists who have offered any apology for their experiments, observes, that “many good, and even dispassionate men, have doubted whether we are entitled, with a view to the welfare of our own species, to make painful experiments on the inferior animals.” That some may have held so absurd an opinion is probable enough : but it is obvious that the object of this statement, which is sometimes made by experimenters, is to direct attention to an extreme case, in the successful refutation of which an unfair advantage is gained, and the mind prejudiced to opposite sentiments. We think that no person of sense will deny not only the propriety, but the duty of experimenting on living animals, were it to be followed by any benefit to mankind.

* * * * *

“The severest experiments, then, are justifiable, where they are undertaken with a view to ascertain any definite and important point, from which improvement in practice may be reasonably expected to result. A single illustra-

*. Spectator, No. 126.

tion may be given. Among the different classes of poisons, narcotics have always attracted a large share of the attention of medical men, both on account of the frequency of their adhibition, and the difficulty of successful treatment. It was known that the more distressing and directly dangerous symptoms arose from some affection of the functions of the brain; that respiration was thereby suspended; and that the fatal failure of the circulation was thus produced, or at least hastened. For it was always observed (during that depressed state of the system, to which the name of coma is given, and which forms the last stage of narcotic poisoning), that even after the last breath was drawn, the heart continued to beat and the circulation to go on, till the blood, no longer oxygenated, stagnated in the vessels of the lungs, and total death ensued. From this, it very obviously followed, that as the mischief lies in the insensibility, or want of correspondence between the brain and the natural respiration, it might be possible, by means of artificial respiration, to keep up the circulation and retard dissolution, till the affection of the brain has time to pass off, and the vital functions gradually recover their natural action. A plan of treatment was thus theoretically deduced from the phenomena observed in the human body. In order to verify it, Mr. Brodie performed experiments on living animals. He administered narcotics to rabbits, and found that he could save the animal, when on the point of death, by exciting artificial respiration. In one instance the animal recovered; even after the operation had been continued for nearly three hours. These experiments, being instituted with a definite and important object in view,

and relating to immediate application in practice, can with propriety be defended. And in like manner, many of the researches of Orfila and others, with regard to the mode of action of various poisons, and the discovery of remedies, have contributed to our means of alleviating human suffering, as well as of yielding aid in protecting innocence, or vindicating the claims of justice."

We feel considerable difficulty in knowing *how* to answer this transcription: we fortunately *know* Dr. Macaulay's opinion from another source,* otherwise, we should have some hesitation in saying which line of argument he adopts in his Essay. One cannot help thinking that our author when he wrote his book, was in the very *unenviable* condition of a man who entertains an *opinion*, but who has not the fortitude to avow it. Most assuredly more than one sentence militates against, if it does not actually contradict the other, as we shall have occasion to show presently.

Our author says that the amount of knowledge acquired by experiments has been very limited, etc:—

To meet this objection and the previous ones, it will be sufficient to transcribe the following successful vindication in Dr. Wilson Philip's own words:—"If the author may be allowed, in addition to what is said in the first part of the foregoing quotation, to speak of anything

* "Cuvierian Natural History Society. President—Professor Jamieson. Vice-Presidents—William Hutcheson, M. D., Samuel Brown.

* * * * * The first Ordinary Meeting will be held on Friday, 23d current, when the following communications will be read:—
1. On the Method of Investigation in the Natural Sciences, by Mr. Brown. 2. On the Cruelty and General Inutility of Vivisections, and other Experiments on Living Animals, by Mr. Macaulay.—University Society's Hall, 19th November, 1838."

which he has himself done, he would say that the employment of galvanism in Indigestion and habitual Asthma, even in its still very limited extent, and during the short period in which it has been used, has saved many times the suffering occasioned by the experiments which led to it. Nay, he could mention single cases from which alone, if it had never been employed in any other, this might be said. He may refer to a letter, which the reader will find in the last part of this Inquiry, from Mr. Earle, respecting the employment of that remedy in St. Bartholomew's Hospital, to prove how much the mode of employing galvanism, suggested by those experiments, tends to relieve some of the most serious diseases we are subject to. Shall not medical men be excused for attempting by such means to relieve the sufferings with which they are constantly surrounded? And even were not the sum of suffering, on the whole, lessened by them, we might perhaps be excused for using the means afforded to us of transferring it from our own species to the inferior animals; but to say nothing of the preservation of human life, who will compare human suffering, with all its recollections, and all its forebodings with the sufferings of the animal which feels only for the present moment. What force do such reflections acquire when it is recollected that the sufferings of one animal may be substituted for those of thousands of our own species!"

And the following opinion of Dr. PARIS "The profession is indebted to Dr. W. Philip, for having proved by experiments related in his Inquiry into the Laws of the Vital Functions, that the muscular fibre, though independent of the nervous system, may, in every instance,

be influenced through it ; from which it follows, as a corollary, that the muscular fibres of the stomach may not only be affected by causes acting directly on them, but by such as act through the medium of the nerves."

Were it necessary, we could bring a host of authority to bear upon our present point, from men who protested against experiments, so long as the dictates of propriety would allow, who now candidly and openly confess the utility of, and necessity for, experiments on living animals.

With the most perfect deference and respect for any opinions coming from Dr. Wilson Philip, I cannot but think, that he *seriously* erred in his judgment, when he considered it necessary to apologise for his experiments ! This apology has been "a famous tool" in the hands of those who advocate the opposite opinion from us. They have argued, "surely we have some good foundation for our fears and doubts, when an experimentalist *himself* requires to vindicate his own proceedings." Now, I cannot see the most distant necessity for a man to apologise for any act, when he is satisfied *in his own mind* of the propriety of that act, and of the good which will ultimately attend the performance of it.

"O, ye race of men !
Though born to soar, why suffer ye a wind
So slight to baffle ye ?"

* * * * *

"Why are thy thoughts thus rivetted, my friend ;
That thou hast slack'd thy pace ? or how
Imports it thee, what thing is whisper'd here ?
Come after me, and to their babblings leave the crowd.
*Be as a tower, that firmly set,
Shakes not its top for any blast that blows.*
He in whose bosom thought on thought shoots out,
Still of his aim is wide, in that the one
Sicklies and wastes to nought the other's strength,"—DANTE.

We reserve much that we have to say on *these* passages by Dr. Macaulay, until we come to the *application* of the argument.

“On admitting the propriety of certain experiments on living animals, it will of course be asked, where is the line of demarcation to be drawn between those which are, and those which are not, justifiable?”

Let us *see* the application of this proposition.

Charitable actions, *as a whole*, are justifiable;—consequently *certain* charitable acts are justifiable. But certain charitable acts are *not* justifiable. Where, then, “is the line of demarcation between those which are and those which are not justifiable?” This *is* a question of questions, my friend! Would you withdraw your charity altogether, because certain of your acts afterwards proved to be abused acts of charity? Would it not be more rational and *proper* in you, to take the *principle* for your guide? Charity is good, proper, and necessary, and we are commanded to bestow acts of charity according to our several capabilities. Abused acts of charity are, in most instances, an affair of the judgment; more inquiry and consideration into the objects of those abused acts of charity would have dictated the propriety of not giving alms to those objects at all, consequently, the donor is more at fault than the receiver.

In like manner, if experiments be justifiable in part, they necessarily are so in whole;—it is the principle with which we have to do; we are not to reason upon the performance of unsuccessful experiments, because more mature deliberation would, in all probability, have dictated their *non*-performance.

Certain experiments are justifiable.

Therefore all experiments are justifiable.

But certain experiments are not justifiable.

Therefore all experiments are unjustifiable.

But if experiments are justifiable.

Certain experiments are justifiable.

Therefore all experiments are justifiable.

We see the fallacy in the second proposition, and we must adopt the first and third.

“ May not every increase of our knowledge of the vital functions be followed by some improvement in practice, although such applications may not be immediately apparent? To this we reply, that an immediate and great evil ought not to be permitted, where there is only the remote possibility of good resulting from it; especially since experience has as yet realized so few of the hopes and promises that have been held out.”

Experiments “ are an immediate and great evil.”

But disease and death are a greater evil.

Consequently the lesser must give way to the greater evil.

‘ Experience ’ ‘ has realized ’ a ‘ few of the hopes and promises that have been held out ’ by experiments.

Experience justifies experiments.

Therefore, experiments are justified by experience.

“ Let the question be put to medical men, what additions of importance have been made to our theoretical knowledge, and what accessions to our resources, either in the prevention or the cure of disease, have been attained strictly through the medium of experiments on living animals, and it will be found that they are in

general at a loss for a reply, or that their answers are confined to a catalogue of a very small extent or variety."

If my reader can spare sufficient time, he may compare this last sentence with what have preceded, and let him ask himself the question—does not one sentence actually contradict and therefore nullify the other? then let him further interrogate *himself* by replying to the following question :—Seeing that the above *defence* of one side of a question is neither philosophically, logically, nor etymologically correct, nor a common-sense process of argumentation, what are we to think of the constituent elements, or bases, upon which the argument is founded?

But we proceed to consider, briefly, some other arguments by our author.

"The whole history of this branch of physiological inquiry from the time of Herophilus, Erasistratus, and the Egyptian dogmatists, who used to dissect living human malefactors, if it does not convince men of science of the almost total inutility of such methods of research, must at least force them to admit, that they are of infinitely less service than it is now the custom to represent them."

So then, an argument of the utility and propriety of Vivisections is to be founded on the experimental inquiries *in the time* of Herophilus, and Erasistratus!!

I *blush* that the least informed disciple of ESCULAPIUS should write a sentence which speaks more than words can tell our author's utter ignorance of the *literature* of his profession.*

* I wish to do every justice to Dr. Macaulay and those from whom I differ in opinion. We should speak of Dr. M., as the Rev. Mr. Macau-

In the first place, I am entitled to doubt the correctness of our author's premises, from the following quotation:—"We read in Authors, that it required the despotic authority of the Egyptian Kings to restrain the public indignation, and to protect the first human Anatomist; the practice was looked upon with abhorrence, and condemned as a heinous impiety: from hence probably arose the report, handed down to posterity, and retailed by both Celsus and Tertullian, that Erasistratus and Herophilus had dissected criminals alive."—(Dr. Black's Historical Sketch of Medicine and Surgery, p. 41.)

For the sake of argument, we will suppose Dr. Macaulay's premises to be sound, what then? Why was HALLER termed the Father of Physiology? and in what condition was Physiology previous to the time of Haller?

"Notwithstanding the value which must have been at all times attached to the study of the animal body, both as holding the first rank in the scale of natural objects, and as being intimately connected with the various departments of medicine, its functions were seldom made a distinct object of investigation until the beginning of the

lay, because he retired from our profession to study for the Church of Scotland, so soon as he received his degree; consequently the severe studies of a University may have prevented him from going beyond the mere *facts* of Medicine. As four years of study are quite insufficient time to acquire *them* as they must be known; therefore the literature and the philosophy of our science remain to be cultivated at a more convenient season. The writers of "the single medical dissertation, of whom such a mortality occurs in its nurseries,"* afford no objection to our remark. It is one thing to acquire a knowledge of the literature of *one* subject for a medical dissertation which all candidates for the degree of Doctor of Medicine must produce, but it is *another* to acquire the same knowledge of the PROFESSION.

* D'Israeli.

last century. Although the writings of the ancient physicians, and of the earlier of the moderns, abound in physiological speculations, they are rarely brought forward in a connected or systematic form ; so that we are obliged to collect our knowledge of their tenets more from a number of scattered fragments, that are dispersed through works on medicine and pathology, than from treatises expressly devoted to the subject.”*

“ Take any of the particular subjects that have occupied the attention of the greatest anatomists and physicians,—the functions of the cérébro-spinal, and ganglionic nervous systems, for example ; and what a mass of vague and absurdly discordant results appears as the fruit of all their inquiries ! After the myriads of experiments by Legallois and Wilson, Amussat and Fleurens, Majendie and Bouillaud, and multitudes of others, it is surely fair to ask, what satisfactory results have been obtained ?”

“ Myriads of experiments,” &c. Myriad literally means “ the number of ten thousand ;” myriads twenty, thirty, or forty thousand. I begin to doubt the accuracy of the Rev. Dr. Macaulay’s statements altogether when he *directly* accuses the above physiologists of having performed myriads of experiments upon living animals ! ! I call upon Dr. Macaulay to *prove* what he has advanced. From the research I have made, I defy Dr. Macaulay to prove any such statement. To write of myriads of animals with the same composure that we *might* talk of the myriads of drops of rain during a thunderstorm !

Dr. Macaulay quotes Legallois, and the rest, with the

* Bostock’s Elem. Syst. Phys. Introd. Obser.

same ease and independence that the Rev. Dr. Styles did the surgeon's apprentice. Dr. M. ought to know to what extent Science and Humanity stand indebted to such men; that each is a polar star on the subject which he has investigated; and that but for them Science would have been CHAOS—a barren desert—a *long dark night*,—as much so as was animate creation when Noah's Ark first touched *bruta tellus*, after the flood. I dare not stop to refute by detail the above passages of our author; I could not be more accused of wasting TIME, than I should be open to the severest censure for presuming to defend them.

“Physiologists know well how small a number of facts there are, universally or even generally admitted, on these subjects; and out of the little list of conclusions that have been placed beyond the reach of controversy, I believe there is scarcely one that has not, or might not have been as surely arrived at by pathological research, and simple observation of the functions of the parts.”

This is a complicated question from what has preceded, and without implying the slightest disrespect, I must observe that our author does not possess the necessary acquaintance with the subject, and therefore is not warranted in drawing so sweeping a conclusion. I pass on, briefly observing, that a diametrically opposite conclusion is the correct one.

There are several other arguments by our author which I will answer without quoting his own words. I have already transcribed more than there is any real occasion for; and my watch tells that time is on the wing, and I am reminded of a passage in my favourite Dante, which says, “Our time demands thrifty using, linger not; away.”

Dr. Macaulay next quotes a passage from Dr. PRITCHARD'S *Work on Insanity*, the purport of which is that M.M. Fleurens, Majendie, Serres, Fodera, and Bouillaud, have attempted to ascertain the functions of different parts of the brain and its appendages, by removing successively parts of these organs from living animals ; that the results of these experiments were not only different from each other, but were opposed to conclusions which had been arrived at years before by a different path.

That men of science, in their endeavours to enlarge the boundaries of science, should err, cannot surprise us ; —they, in common with men of the world, “are but things of air, and as a substance, treat an empty shade.” Surely, we, who are but *lookers on*, should not *nip* such endeavours in the bud ; the most unexpected discoveries *might* have resulted ; and when we see attempts made by individuals, whose names will have a place in the Book of *Posterity* we must be silent.

This exposition is followed up by a long list of “cruelties” which have been performed by those who have attempted to institute a new philosophy of mind—phrenology. From what attention I have given to this science, I cannot bring myself to think it possible to subvert *one* of the grand props upon which our most holy religion rests—that the mind is immaterial : I dismiss this subject, then, with the remark, that since we have the most unequivocal proof that TRUTH and the Benefit of Man, were the sole objects of those who have wished to establish Phrenology, we are bound to treat with respect, if not with gratitude, such *endeavours*.

“ Medical professors and lecturers, instead of warning their students against such methods of inquiry, as equally useless and inhuman, and pointing out the confusion and errors, and absurdities, which they are apt to introduce into physiological science, too often immediately encourage them to similar investigations. But we trust that more attention will be paid to the human and philosophical method of inquiry by clinical and pathological observations, of which Dr. Abercrombie in this country, and M. Foville on the Continent, have set such excellent examples.”

Dr. Macaulay's first sentence is sufficiently answered by asking a question—what greater authority can be adduced than that of the ever venerable HALLER, who, himself, not only exhorted to, but actually assisted his pupils in performing their experiments?

The second sentence of our author implies that he would have us acquire a knowledge of *function* by paying more attention to “clinical and pathological observations.”

“ The true principles of Physiology are the only base on which pathological opinions can claim a sure foundation; and it is certain that an attempt to gain an accurate knowledge of the causes and action of disease is vain and futile, unless it be assisted by a previous accurate conception of the healthful functions.”*

Next follow in our author's book, several “barbarities” in detail by Dr. Brachet.

Now, so much has already been said against this able

* Translator's Preface to Rudolphi's Physiology.

physiologist and physician, that we deem it but common justice to place his views before the public ; his preface is long, but that shall not form any obstacle to our transcribing it, for which, see Appendix. (6.)

We fear our author has forgotten the following wholesome advice, and that in his hurry to condemn, he has not made himself sufficiently acquainted with Brachet's objects in performing his experiments. "A work should be judged by its design and its execution, and not by any preconceived notion of what it ought to be according to the critic, rather than the author."—(D'Israeli.)

"A little more attention to the principles of inductive reasoning would have prevented nearly all the cruelties occasioned by these discussions."

Will Dr. M. have the goodness to inform us how we could study *phenomena* on the principles of inductive reasoning? To reason is to think; and how can we think upon phenomena which we do not see? When Majendie exposed the stomach of a living animal to view, in distrust of seeing the contractions of that viscus, which all physiologists said took place, and when he saw it dilating under stimuli, he *saw* the phenomenon first with his physical eye, and then he reasoned upon what he had seen through his mental eye. How, otherwise, could Majendie apply the inductive philosophy? If he had reasoned upon the *ipse dixit* of his predecessors, he would have reasoned upon false premises, in supposing the stomach contracted under stimuli, when *he* found that it actually dilated.

Hence comes the question, of what avail is it to apply the principles of inductive reasoning, when we *never can*

be sure that our premises are sound? How can we be certain that any one organ fulfils a particular function, unless we *see* it in action? We may imagine that it performs fifty other different functions, not one of which it may perform, and if we apply the reasoning faculty on such suppositions, what certain result can we expect?

The reader will perceive the error into which the learned doctor has fallen in taking it for granted that our premises *can* always be correct.

Dr. M. goes on to say that, "It was not, however, by such means that Harvey was led to his great discovery."

We will not stop to inquire whether this statement be true or not; we will take our author on his own ground.

Harvey observed that the valves in the veins were placed in a particular direction, and he said, there is design in this. Now, all his reasoning upon this observation would not *prove* the truth of the result which he had come to on the subject; therefore he performed experiments to *prove* that he was right in his conjectures. Had he not proved this matter by experiment, as Majendie did, he might equally have been in the wrong with Majendie's predecessors.

This leads me to remark, that all the important observations that have been made, and the principles of inductive reasoning which have been applied to these observations, have nevertheless left the subjects in uncertainty and obscurity.

The reasoners might be right and they might be wrong—they wanted the *experimentum crucis*; in other words, they must demonstrate the *truth* by experiments on living animals.

So that, after all that has been said, it will be seen that the dispute is about some *shades* of difference.

The question is, can physiological science be successfully cultivated without *experiment*?

It matters not whether *observation* be a sufficiently solid basis to build our reasonings upon, because it is one thing to *observe*, and another to observe *correctly*, and I have already spoken of the difficulties attendant upon making *correct* observations; what avails our observation if we cannot rely upon it? Observation points out two roads to a truth,—a correct and an incorrect one; it *is* experiment which *proves* which is the correct road.

“I have already stated, that operations on living animals may be of essential service to science, and I admit that, in some rare and remarkable instances they have already been so.”

I will not answer this question as it *should* be answered. After our author has exhausted the few *particulars* which he could select from so wide an extent of authorship, as that to which *PHYSIC* belongs, he is obliged to *beg the question*, and insert a quiet though not the less certain acquiescence of the necessity of experiments.

We will now point out the grand error of our author in selecting *particulars*; the question must be considered, *as a whole*,—Is Experimental Physiology a necessary, and therefore a justifiable science, or is it not? How absurd and unjust, contrary alike to common sense, and all legitimate principles of inquiry, to endeavour to decide so important a topic by culling out experiments, because he thought he could lay hold upon some minor and unimportant objections!

With as much propriety might we argue that we should not live under a Monarchical Government, because an author had pointed out that certain members of that government had not discharged their duty, but had done much harm.

Would it be right to reason upon the actions of those particular members, as to the propriety of any longer supporting that government? The question is, Is a Monarchical Government to exist, and therefore to be supported, or is it not?

We must consider the question as a *whole*; we have no right to bring those particulars into our consideration at all, because, those men who constitute the particulars, have no right to take part in the government, and would, in all probability, never have been admitted into power, had more consideration been given to several requisites which men *must* possess, ere they can be admitted with propriety and safety.

Such, then, is the precise condition of our argument.

“ But is it on this account to be tolerated, that every dabbler in physiological science, that every one desirous of scientific notoriety, by however disgraceful means obtained, shall adduce the names of Harvey, and Asellius, of Haller and Bell, in defence of their own inhuman and useless cruelties.”

MAN WRONGS AND TIME AVENGES.

From what has preceded, we have every reason to believe that dabblers in physiological science have no other existence than in the imagination. We *can* believe what we *wish* to believe!

Are ingenuous youth at College, or even surgeons' ap-

prentices, to be debarred from searching into the secrets of their own corporeal frames? Let us admire and cherish this searching spirit, but let us not check rashly, or even in the slightest degree retard its progress.*

What were Harvey, Asellius, Haller and Bell? Unquestionably young men! students!! and it may be also surgeons' apprentices!!! †

Biography informs us that the seeds of their discoveries were sown at a very early period. And I am happy to think that many of my young friends have commenced a career,—have sown the seed of a rich and plentiful harvest.

Be gracious Heav'n! for now laborious man
Has done his part. Ye fostering breezes, blow!
Ye soft'ning dews; ye tender show'rs, descend!
And temper all, thou world reviving sun,
Into the perfect year!--

THOMSON.

* * * * *

All is the gift of Industry; whate'er
Exalts, embellishes, and renders life delightful.—*Ibid.*

Dr. M. triumphantly asks: "Yet, after all the experiments and discussions concerning the physiology of

* "So true is in science, the remark of Bacon, that no natural phenomenon can be adequately studied in *itself alone*, but, to be understood, must be considered *as it stands connected with all nature*."—HERSCHEL.

But if we are not to study the *phenomena of LIFE*, we cannot comply with the recommendation of two of the greatest philosophers that have adorned the present and the past. The candid reader will do well to encourage that *latitude* of investigation and to foster that open and unfettered spirit of inquiry, which the above sentence so eminently upholds.—*Author.*

† "Where was there ever any work entitled to be called truly perfect, in the formation of which the strength and enthusiasm of youth have not laboured in companionship with the experience and maturity of manhood?"—*Schlegel.*

vomiting, and after the hundreds of cruel dissections that have been made, I should like to know whether there is the slightest difference in our practice, either with regard to the administration of emetics, or the management of any single point connected with the process?"

It is impossible there could be the slightest difference in our practice in this matter : to administer, is to introduce any solid or fluid into the stomach ; the necessary and invariable process of vomiting consists in the stomach rejecting its contents ; but if there were any difference, as our author supposes there might be, the first step to attain such knowledge would be to acquire accurate views of the physiology of the parts concerned in vomiting.

Dr. M. makes several remarks upon Dr. Wilson Philip's discoveries, and in quoting the passage which *we* have already done, as to the employment of galvanism in asthma, says : " This is the sole topic of the last or practical department of his ' Experimental Inquiry ;' and we should certainly have expected some more important and undisputed good to have been educed from an inquiry so ably conducted, and from which its author had led its readers to hope so much."

Is it of little importance to make a discovery, which alleviates the sufferings attendant upon indigestion and habitual asthma, two of the most frequent complaints of the old and young ? It would be idle in us to pause to refute an objection, which is not more unpardonable than it is untrue.

Dr. M. states a few more objections, which we shall answer as we proceed.

The next work before me is " The Rights of Animals,

and Man's obligation to treat them with Humanity. By William H. Drummond, D.D." &c.

I perceive Dr. Drummond has devoted several passages to our proper subject. As I have no intention of ushering into the world an Ainsworth's or Delatanville Dictionary, my readers can only expect me to answer our author's criticisms in a very general manner.

"Section Sixth, Love of Science Perverted.—Vivisection."

Dr. D. goes on to say :—"The writer of these pages is not such an enemy to science, as to affirm that no animal should in any case be brought a living victim to her shrine. He admits that some useful discoveries, as those of the Lacteals, and of the circulation of the blood, have been made, or most clearly illustrated by vivisection. When a great and valuable object is to be attained, some expense of pain and suffering must be allowed. The life of a human being is more to be prized than that of a brute, and if one can be saved by the death of the other, there can be no hesitation as to the latter. But what the friends of humanity may and do justly complain of, is not only a wanton sacrifice of life, but the infliction of cruel and lingering torments, for the gratification of a useless curiosity. When facts have been ascertained and established by men of acknowledged skill and merited reputation, wherefore is anysciolist to venture on a repetition of the experiments by which those facts have been demonstrated? Wherefore are boys, who have just commenced the study of anatomy, to make upon living creatures their incipient efforts in this difficult art? Is it not enough to attend to the instructions of their teachers, and to

practice upon inanimate creatures? May they not rest assured that the knowledge of which they are in quest has been already gained, and can be imparted to them on much more certain grounds than they could ever lay for themselves? Or, should they be exhorted to repeat all that has already been done, with Asellius to dissect living dogs to ascertain the existence and functions of the lacteals, and with Haller, employ a "hammer and chisel" to open the skulls of goats and cats, to see if there be any motion in the brain corresponding to the respiration? Is this the way to train them for treating their future patients with tenderness?"

The first four sentences of this paragraph contain every thing for which we are contending; they form our grand text—what more could be desired? We shall shortly find, however, that, the author vacillates and nullifies them by his erroneous conclusions from false premises.

The next sentence is one, the falsity of which, we consider, we have already answered. It is a pity Dr. D. did not note "the times and places," where a "useless curiosity" had been carried on.

The concluding sentences are unnecessary: we perceive, however, that our author, in speaking of "boys, who have just commenced the study of anatomy," reasons upon the vulgar and very erroneous notion, that the powers of the mind are developed and grow with the physical years, than which there are no two things we find less go together.

What will Dr. Drummond think of the following illustrations of men, who became professors, before they were scarcely out of *his* list! "The first MUNRO was Pro-

fessor of Anatomy at the age of 21 ; the second MUNRO at the age of 23 ; MACLAURIN was Professor of Mathematics at 19 ; DUGALD STEWART at 22 ;" Professors FORBES and CHRISTISON, were, to the best of my recollection, installed before the 23d year of their age.

A host of such examples crowd upon my memory, of men in all the walks of SCIENCE.

I dwell the more upon this topic, because I have had reasons to think that young men have been kept back a pace (that is to say, *if* external circumstances can influence that energetic and never-tiring *Spirit*, which, I believe, only to be possible in individuals, marked by strong constitutional sensibility) from the prevailing opinion, which is the subject of the present digression. We must never forget, "that it is the individual man who thinks, and discovers ; not any aggregate or mass of men."*

I respectfully caution *seniors* in science from putting the gentlest curb upon the youthful, but active and inquiring spirit ; let them consider it to be their duty, no less than their pleasure, to cherish the fond wishes of the tender aspirant, and to direct his efforts into proper channels ; and then, treat him as the racer does his steed, give him the reins, and let him go.

"He that directs the (young) wandering traveller,
Doth, as it were, light another torch by his own ;
Which gives him ne'er the less light, for that
It gave another."—ENNIUS.

I know well that a young man is too apt to be considered forward and impertinent, when he endeavours to

* Address by Professor Sir William Hamilton, before the British Association.

“pass by” the multitude around him; but especially if he ventures to think for *himself*, and dare call *authority* in question; hence, *one* reason why Dr. Craigie remarked in his testimonial, which he was requested to give, a year or two back :—“And because I have seen reason to conclude that testimonials are numerous, chiefly when legitimate claims are deficient.”

The corollary from this digression is, that we must not check, but encourage the efforts, and cherish that ceaseless spirit of curiosity in young men, whether they come under the denomination of “boys,” “surgeons’ apprentices,” or “medical students.”

Biography furnishes the most unequivocal testimony, that this inquiring Spirit is the happiest and surest criterion of future eminence.

Dr. Drummond and others have quoted CELSUS as an authority. It is a question of much doubt whether Celsus practised his profession at all. His claims upon posterity consist in having been a very eminent literary character, and having possessed great versatility of talent; certainly the last man Dr. D. and others should have brought forward as an authority for their argument. We may further remark, that Celsus is not considered as an authority in physic; his work is written in a purely classical style, and for that reason, is well adapted as a book for Examination at the various Boards.

Our author has quoted Dr. Elliotson, who speaks strongly against the several French experimentalists, an account of some of whose cruelties we have already detailed. Candour obliges us to remark that Dr. Elliotson and others should first have ascertained what kind of

experiments have been performed at *home*, before he was so uncourteous to our Continental neighbours. Consult appendix (5.)

The candid reader having read Sir W. Hamilton's Experiments, we ask him, if our Continental brethren are more to be held up as guilty of the greatest barbarities upon the lower animals? We would adduce *several* such so-called cruelties from the experiments of scientific men at *home*, which are equally to be reprobated with any performed on the Continent of Europe!

I have already proved that those experiments which are performed *abroad*, and we may add, those performed at home, do not come under the appellation of cruelty or barbarity, first, because very little real pain attend those so-called cruel experiments, and secondly, because, the motives which urged the performance of them, were those of the purest philanthropy and benevolence.

Several minor objections are fully discussed by Dr. Drummond, the whole of which we consider we have fully and fairly answered already.

The last work, upon which we shall offer any remarks in the present chapter is, "The Obligation and Extent of Humanity to Brutes." By W. Youatt, late Lecturer on Veterinary Medicine, at University College, London.

Mr. Youatt devotes a separate Chapter "On the Dissecting of Living Animals." To notice any one of the arguments which Mr. Y. has advanced, would be to go over the ground we have already travelled. Mr. Y., however, has given the opinions of a few distinguished members of the medical profession, which we will quote, and upon which we shall comment.

“ I believe the profession are aware of the unwarrantableness of such experiments, except to determine some important question ; and the necessity of performing them so as to cause as little suffering as possible.”—*John Abernethy*.

Mr. Abernethy only can allude to *particulars*, or the ‘cruelties’ of the fore-named authors. The remainder of the sentence is *everything* for which which we contend. Consequently Mr. Y. has strangely misconstrued Mr. A.’s meaning, in thinking that the distinguished surgeon in question in the least degree disapproved of *Experimental Physiology*.

“ Experiments on living animals should never be made unless the result is to ascertain some points of importance to science or the healing art.”—*Everard Home*.

Our comment equally applies to this sentence. Strange error, indeed, on the part of Mr. Youatt.

“ The records of our art for more than 2000 years, while they detail numerous experimental inquiries, and many of them no less inconsistent with the dignity of philosophy than at variance with the best feelings of our nature, furnish very insufficient proofs of their corresponding utility.”—*B. Golding*.

It is sufficient to return to the 18th century ! In what condition was Physiological, nay Medical Science, previous to the time of HALLER and HUNTER ?

“ I cannot conceal my opinion, that the public exhibition of torturing experiments on animals, exercises a corrupting influence on the minds of those who witness them. The natural feelings of commiseration which we entertain for the sufferings of a helpless and unoffending animal

are entwined with the best and tenderest sympathies of our nature ; and I firmly believe that we cannot part with one without tearing up the others by the very roots.”—*Philip Crampton*.

This paragraph, in common with many others, furnishes a remarkable CURIOSITY in *Medical Literature*.

unchangeable Unchangeable though it be, we cannot help thinking that the *educated* mind, on particular subjects, does not think for *itself*, but is guided by *habit*. It is said, “we are creatures of habit,” but it is a *bad case* when the *inquiring mind* takes on this habit. Certain it is that Mr. Crampton has, in this instance, fallen into that fatal snare.

“I must own that it appears to me that the law should forbid, under suitable penalties, the infliction of severe and protracted misery on living animals, at the will and pleasure of any individual.”—~~Sir A. Bardsley~~ *D^r Bardsley*

The *Law* of Man is one thing—the Law of CONSCIENCE is another. I am lowered in my own estimation when I think that any member of our profession would so far sink the dignity of its professors, by wishing to bring *Physic* under the regulation and tie of Law !

It will be a *bad case*, indeed, if this should come about, but it *never* shall ! Diligite justitiam qui judicatis terram. More of this *in a proper place*.

“I abhor the dissections of living animals, on account of their want of ‘just feeling,’ and ‘sound philosophy.’” —*T. M^r Whirter*.

A catholic doctrine. Mr. M^r Whirter should have defined *his* meaning of ‘just feeling’ and ‘sound philosophy.’

“ Not bad *simpliciter*, nor good,
But only as they're understood.”

Mr. Youatt concludes his sorrowful list of “cruelties” with the following :—

“ The last testimonial we give at length. It was signed by twenty medical gentlemen of Newcastle-upon-Tyne, and a similar one by thirty-eight resident in Bath.”

“ We, whose names are underwritten, medical persons, do hereby engage and declare that we will, as far as in us lies, prevent and discourage by our example, influence, and dissuasion, those painful and cruel anatomical experiments upon living animals, which, to the disgrace of science, in our opinion, are made ; sometimes without necessity or utility, and frequently without any adequate end, under the plea of promoting medical knowledge. The gratification of mere curiosity, the illustration of favourite but unessential theories, or the repetition of any known and conclusive experiment, we consider very insufficient motives for the infliction of torture. We do thus protest against and reprobate such conduct, esteeming it wholly unwarrantable and discreditable to our profession. And we earnestly recommend this subject to the serious consideration of all students in anatomy ; entreating them, under a sense of moral principle, not to be misled by the practice of others, who have thoughtlessly (as we hope) but unfortunately, degraded researches, otherwise so meritorious and important.”

Such is the language of men who pursue an *ignis fatuus*. We will leave them to their *delusions*.

“ Entire affection scorneth nicer hands.”

CHAPTER II.

WE return to those authors whom we have just left, to consider other arguments by them, from which we differ.

We must premise that, we feel considerable difficulty in deciphering the various arguments treated by Dr. Chalmers, in his very eloquent sermon on "Cruelty to Animals." The abstract truths, or philosophical questions discussed by him are so much clothed in that beautiful imagery, that irresistible and overwhelming *language* of the heart, doubtless so necessary to "carry along" the feelings, and to convince the minds of a popular audience.

The individual mind, in the retirement of study, has no need of such auxiliaries; the plainer the diction, the less elegant and eloquent the clothing is which covers philosophical propositions, the more will the mind comprehend their real import and object. We have *unrobed* our author's arguments, and have endeavoured to reason upon them in the light of manifest and *simple* propositions.

We pass over the first paragraph of Dr. Chalmers's discourse, and we will commence our remarks on the second. Dr. Chalmers goes on to say, "that nature seems to have limited and circumscribed our power of noticing, and just for the purpose of shielding us from the pain of too pungent, or too incessant a sympathy."

We cannot admit the correctness of the idea conveyed by this first clause of the quotation. We believe that man, from erroneous views in educating *himself*, has "limited and circumscribed our power of noticing," but it would be eminently irreligious to think that nature has done so. This were to admit an imperfection in the Godhead. Man was made for this world, and was provided mentally, and physically, with the most unlimited powers of fulfilling the objects for which he was sent into it. That he has not done so, is no argument in support of our author's proposition. We cannot therefore subscribe to the opinion that "one of the exquisite adaptations in the mechanism of the human frame may be observed in the very imperfection of the human faculties." There can be no such thing as our author supposes. Why need we trouble ourselves in educating our 'human faculties,' if already they are imperfect in *themselves*? *Ex nihilo nihil fit*; we cannot hope to educate faculties, some of the elements of which are wanting, or imperfect, because education has little or nothing to take hold of. "The most frequently adduced example of this, is the limited power of that organ which is the instrument of vision." The anatomy and philosophy of that organ, and the laws of optics, speak very different sentiments.

A blind man, whose physical eye *is* imperfect, sees as

vividly, correctly, and harmoniously, into the *real* field of vision, as the man, whose physical eye is most perfect. A man, blind from birth, acquires, through the common inlet of knowledge, *perception*, as correct views of the horizon, which bounds our physical vision, as that physical eye which has for a long term of years seen this boundary. Our physical eye could never give us the least insight into a knowledge of the Universe. We have read of a blind mathematician, and of a blind astronomer, and we *feel* that it is by our mental vision that we acquire what amount of knowledge we wish to obtain. The question of *extent* of human knowledge, is what every man can measure by his own rule—*his own industry*; those injurious and perilous terms, genius,* talent, and others, have no existence; *industry* is the legitimate term of all of them. If a member of our profession has acquired as much *bona fide* knowledge at the age of 26, as another has at 66, it is only because he has applied himself more industriously and *methodically*; for it is by the latter, that we save time, while all our industry without method, would only tend to destroy it. To say that one man has genius, another talent, and that the multitude possess neither, is to admit partiality, or to believe that all men were not introduced into this world on the same footing. It is only by believing that the family of man, at birth,

* The least objectionable definition of Genius, of the many, which, at one time or another I have read, is that of the immortal GOETHE:—"The greatest genius will never be worth much if he pretends to draw exclusively from his own resources. What is genius but the faculty of seizing and turning to account everything that strikes us; of co-ordinating and breathing life into all the materials that present themselves; of taking here marble, there brass, and building a lasting monument with them?"—S. Austin's Trans.

are upon equality, and possess the same *real* privileges of mental acquisition—that we can admit that order and harmony exist in the universe at all. Consequently there cannot be any imperfection of the human faculties.

“Did he actually see, for example, in the beverage which he carried to his lips, that teeming multitude of sentient and susceptible creatures wherewith it is pervaded: or if it were alike palpable to his senses, that, by the crush of every footstep, he inflicted upon thousands the pangs of dissolution, then it is apprehended that, to man as he is, the world would be insupportable.” We cannot see the force of this appeal. There are few persons but what know all this, and I have frequently heard the fact mentioned previous to drinking a glass of water. We believe that the mental eye can as strongly pourtray to the feelings such objects, as much so as if they were seen by the physical eye. Our feelings are *adapted* to such things, because they exist in nature, and because we form a part of nature. The rational and *thinking* man accommodates and educates his feelings; and he teaches himself to believe that, “in nature there is nothing melancholy,” nor disagreeable, nor disgusting. The many sights we daily encounter, which effeminacy or fancy term disgusting, are not so in reality; that mind must be *morbid* indeed, which thinks that any thing we can see, should be otherwise than what the Deity intended we should see, and for the proper observance of which He has furnished us with faculties.

Dr. Chalmers treats of “the inertness of our reflective faculties.” We do not presume to place our opinion against the opinion of any one quoted in our pages; we, may,

however, be permitted to say that we cannot agree with particular statements, provided we give our reasons for so doing. Now, the word "inertness" may be variously deciphered, so that we may not attach that meaning to the expression, which the distinguished author intended to convey. We believe our author to mean that our reflective faculties are obtuse or incapable of performing their assigned functions. We cannot subscribe to this opinion. We humbly conceive that the expression contradicts itself. How can our faculties reflect or think, if they be inert? We speak of a man who thinks strongly, acutely, or energetically, that is, his sole *attention* and collective intellectual faculties are engrossed upon one particular topic; but we never say that a man thinks feebly, or imperfectly; we say the attention has been feebly engaged, because, attention is the first step to thought. To *think*, implies strength, energy, concentration. The mathematician gives his attention; the metaphysician gives his thought. They are perfectly distinct. Most men can fix their attention upon an interesting topic, few men can carry on a process of thought concerning that object. Consequently we cannot *see* how a man's reflective or thinking faculties can be inert.

"He is intent on the science of those phenomena which he investigates, and bethinks not himself of the suffering which they involve to the unhappy animal."

"So far from the sympathies of his nature being reversed, or even annihilated, there is in most cases an effort, and of great strenuousness, to keep them down; and his heart is differently affected from that of other men, just because the regards of his mental eye are differently pointed from those of other men."

We possess the most unequivocal testimony of the truth of the direct contrary to what the venerable author has expressed in the first sentence.

The ever venerable HALLER's feelings would not allow him to perform a surgical operation on the human subject, notwithstanding that he felt himself called upon to operate so largely on the lower animals.

In reading his works, we repeatedly fall in with passages, of which the following is a specimen:—"De irritabili natura vasorum minimorum omitto philosophari, donec ea per experimentum fit evicta."

Dr. Wilson Philip has eloquently said, "In the character of those who have been engaged in such experiments, we see a sanction for them of a different kind. Where shall we find a man of a stronger moral sense or sounder principles of religion than Boerhaave was? If such a man has existed it was Haller, whose observations on the Christian religion are esteemed even by those who devote their lives to its study, and whose letters to his daughter shew how much he was alive to all the gentler feelings; yet of all the physiologists of his time, he made most experiments on living animals, and most frequently appeals to the evidence afforded by them. Where shall we find a brighter ornament to the church, or to human nature, than the celebrated Hales, emphatically called the Christian Philosopher, yet he scrupled not to make experiments on living animals, to improve our knowledge of physiology. Many similar examples might be adduced."

Dr. Chalmers continues;—"But still, could merely the same interesting phenomena have been evolved without pain, he would like it better. Only, he will not be repelled

from the study of them by pain. Even he would have had more comfort in the study of a complex automaton, that gave out the same results on the same application. Only, he will not shrink from the necessary incisions, and openings, and separation of parts, although, instead of a lifeless automaton, it should be a sentient and sorely agonized animal. So that there is not even with him any reversal of the law of sympathy. There may be the feebleness, or there may be the negation of it. Certainly it is, that it has given way to other laws of superior force in his constitution. And, without imputing to him aught so monstrous as the positive love of suffering, we may even admit for him a hatred of suffering, but that the love of science had overborne it."

It does not appear to have entered the mind of Dr. Chalmers that the most decided good to science and humanity has already arisen from the graphic views we have just transcribed. I have already said that, it is only by inflicting pain that we can look for a decided good. *It is a law of our nature.*

The feelings which prompt men of science to forward its interests, "through good and bad report," belong to one class; the feelings of the heart which prompt the community at large to condemn and hinder scientific men from carrying out their researches, because pain is a necessary and unavoidable attendant upon such inquiries are of another class. We would do well to consider whether, in putting a check upon scientific inquiries, we are not increasing to a ten-fold degree those sufferings which we are so solicitous to remove, not upon the lower animals who are the subjects of pain, but upon man for whom all

this pain is inflicted? This argument has never once been advanced by any one who has written so largely on our general question.

“But the love of science had overborne it.” What but the purest benevolence, religion, and philanthropy, could generate a love of science? We believe such a love to be of the most disinterested kind. It cannot be advanced that riches and rank are the objects of such a love. No: those who have most advanced the cause of science, with few exceptions, have not been assisted by the former, and certainly they have received little encouragement from the latter. Who that has read Dr. Adams’ life of Mr. JOHN HUNTER, does not acutely *feel* for the apathy that Government and the Public too often showed in their tardy attempts to aid his never tiring, his ceaseless endeavours; but particularly for the difficulties which his talented and beloved widow and family experienced, ere friends came forward to screen them from the chilling blasts of poverty, and neglect! What must have been the pangs of that heart which penned the following lines, in the hope that they would be inscribed on a tablet, and placed near to the resting place of the illustrious departed! But no! THEY WERE REFUSED A PLACE IN THE TEMPLE OF GOD!

“During this time she” (Mrs. Hunter,) “published a volume of poems, which possess considerable merit as light compositions. In 1804 she composed the following Epitaph, with the design of having it inscribed on a marble tablet to be placed over the remains of her late husband in St. Martin’s Church; a design, however, which it was intimated to her by Dr. Hamilton, the rector, was contrary to the rules of the Church:”—

"Here rests in awful silence, cold and still,
One, whom no common sparks of genius fired;
Whose reach of thought Nature alone could fill,
Whose deep research the love of Truth inspired.

Hunter! if years of toil and watchful care,
If the vast labours of a powerful mind
To soothe the ills humanity must share,
Deserve the grateful plaudits of mankind.—

Then be each human weakness buried here
Envy would raise to dim a name so bright:
Those specks which in the orb of day appear
Take nothing from his warm and welcome light."—ANNE HUNTER.

DANTE has well said (for he had *his* share of neglect,
or whatever we may please to term it.*):—

"The truly great
Have only one age, and from one visible space
Shed influence! They, both in power and act,
Are permanent, and Time is not with them,
Save as it worketh for them, they in it.
Nor less a sacred roll, than those of old,
And to be placed, as they, with gradual fame
Among the archives of mankind, thy work
Makes audible a linked lay of Truth,
Of Truth profound a sweet continuous lay,
Not learnt, but native, her own natural notes!"

"YOU WILL NOT SOON MEET WITH ANOTHER JOHN
HUNTER."

Candid reader, if you be a student of my profession, (but
you know the inquirer into nature is ever a STUDENT:
there exists no Royal College which can grant you a di-
ploma that you have reached the *summum bonum* of

* "The noble, opulent citizen, the statesman and minister, the profound philosopher, accustomed in all and each of these characters to the respectful homage of his countrymen, was now, to use his own words, 'driven about by the cold wind that springs out of sad poverty,' and compelled 'to taste how bitter is another's bread, how hard it is to mount and to descend another's stairs.' But the change from affluence to want was not the worst evil that awaited the high-minded patriot in banishment. For this he found compensation in the consciousness of having done his duty to his country."—LIFE OF DANTE.

human knowledge. We are all students, from the least, even to the greatest !) treasure up these words as being the “precious life-blood of a Master Spirit.”

But I am forgetting that “love of science” is my text, not commentaries on medical biography.

Well then, as we must recur to the subject, we will not further, at present, enlarge on this topic.

There are other arguments by our venerable author, from which we cannot but dissent. These will be answered in the course of the work. Before parting with one another, it is proper to observe that his sermon was addressed to the *public mind*; our remarks are intended for the *individual mind*, between which the greatest difference exists.

We next proceed to consider a few opinions by the Rev. Dr. Styles.

“Those creatures which prey upon each other obey an instinct which destroys the life of their victim at the least possible expense of pain. It is usually in the night time, and in the hour of sleep, that they sink under the fangs and teeth of their destroyers. Twenty strokes sent home in one instant to the sources of life afford no leisure to reflect that they are about to lose it. That fatal moment is not embittered to them by any of the feelings which render it so painful to most of the human race, regret for the past and solicitude about futurity. They feel the pang of nature, but not of mind; it is momentary, and then follows the undisturbed repose, the slumber of eternal rest.”

Of the many examples which could be adduced to refute the above paragraph, we select the following:—

“ But we have a plant in our gardens, a native of North America, than which none can be more destructive of animal life, the dogbane (*apocynum androsæmifolium*,) which is generally conducive to the death of every fly that settles upon it. Allured by the honey on the nectary of the expanded blossom, the instant the trunk is protruded to feed on it, the filaments close, and catching the fly by the extremity of the proboscis, detain the poor prisoner writhing in protracted struggles till released by death, a death apparently occasioned by exhaustion alone; the filaments then relax, and the body falls to the ground. The plant will at times be dusky from the numbers of imprisoned wretches.”*

Dr. Duncan makes the following remarks:—“ The power which the various race of spiders possess of spinning webs to entrap their prey is well known; but there are some curious particulars connected with this subject which, though not generally understood, are exceedingly interesting.

“ This little animal is a devourer of flies and other insects, and seems to be intended by the Creator to fulfil the important part of preserving the balance in that department of the animal creation with which it is connected, by keeping in check the tendency to multiply to an inconvenient degree. In all the orders of living beings, such a provision is made, from the lion and hyena which roam the forest, spreading carnage and desolation around, to the invisible tyrant of the inferior tribes, which the solar microscope has disclosed, called, on account of its

* The Journal of a Naturalist, London, 1829.

insatiable voracity, the water tiger. To accomplish this useful object, the spider is endowed with peculiar propensities as well as instincts, the most remarkable of which is that of preparing and spreading nets to ensnare their prey.

The same distinguished divine, in speaking of the lion ant, says :—" Of all the animals, evidently formed for the purpose of keeping the insect world in check by its predacious habits, there is none so remarkable or so formidable as the lion-ant,—an insect which bears no alliance, except in some resemblance of form, to that more interesting creature whose name it bears."

" No animal fares more sumptuously, without ever stirring from its retreat." " Apparently

conscious of this, the lion-ant remains in patient expectation, ready to profit by that accident which throws some heedless little animal into his den."

" When the insect is fallen thus low, no efforts can release it ; its enemy seizes it with its hollow feelers, and darting them both into its body, sucks out all the hapless animal's juices with the utmost greediness."

Dr. Styles has the following extraordinary argument ; indeed it would be difficult to find its parallel.

" It surely is not to the exertions of the torturers of the lower animals, that we are indebted for the mild and humane spirit which breathes through the administration of our criminal justice, and which has made the punishment of death a thing so strange, that when the sentence is pronounced, it is scarcely ever executed."

We are *very* imaginative ! but we have failed in creating the most distant connection between this argument and our proper subject.

We understand the "torturers of the lower animals" to mean vivisectionists. The question which Dr. Styles should have considered was, whether CAPITAL PUNISHMENTS had ever any right to be instituted at all. To hang a man because he has killed his neighbour is *not* to conform to the Scriptural command—"return good for evil." Capital punishments increase the very evil the law is so anxious to remove.

When a man has killed another, *teach* him to do better, to *know* better. What avails it to take away his life!

Ars non vi, should be the TEXT. It is unnecessary to pause and show the utter absurdity of Dr. Styles' simile, when, very properly, we dispute the *grounds* upon which his illustration is founded.

"Dr. Millengen accounts for the superlative cruelties daily practised by the French physiologists, and which we have had so much reason to condemn by ascribing them to their familiarity, with the crimes of their revolution. "Brought up," he says, "in early life," amidst these "complicated horrors, I have been sadly convinced that the contagion of cruelty is much more doubtless and active than that of pestilence."

We will not descend to politics. We dare not taint our pages, dedicated to scientific inquiry, by anything so heterogeneous. It is sufficient to observe here, that, we *have* a philosophical explanation ready for the French physiologists, which we shall develop in a proper place.

We quote the following opinions of Dr. Millengen, from the appendix to Dr. Styles' work:—

"But I am now come to a much more important con-

sideration—the benefit to mankind that has occurred, or that may be derived from such experiments. And here I must give as my most decided opinion, that if any such beneficial results did arise from the inquiries, they were not commensurate with the barbarity of the experiments ; nay, I shall endeavour to show, that they are frequently more likely to deceive us, by propping up fallacious and tottering theories, than to shed any valuable light on the subjects of investigation.”

We have already given the most unequivocal proof of the falsity of this statement, consequently Dr. M's. opinion falls to the ground.

“ I do maintain that the phenomena of life differ widely between man and animals, and the very nervous influences which we seek to discover are, in life, of a nature totally different.”

The phenomena of life in most instances, if not in all, are precisely the same in the lower animals, as in man. The best proof of this is, not so much the close analogy which subsists between them, and which Dr. Millengen is obliged to admit, but the important fact, (which is no small argument in favour of experimental physiology,) that experiments on the lower animals have verified the conclusions which had previously been arrived at from observation and the consequences of diseases in the human subject. If we fracture a bone in a lower animal, or cut a muscle, or inflict what injury we may, the process of cure, in them, is precisely similar to what would take place in man. What stronger evidence could we have that the phenomena of life are precisely the same in the one, as in the other ?

“ Were it not so, would the senses of different animals, rendered more or less acute or obtuse according to their natural pursuits and protective habits, be so materially unequal ?” All this we find in man. The most superficial observer has noticed that, one individual is all sensibility, and that another is as void of it, all which is owing to the particular temperament of the individual, which temperament is the cause of the inequality in the natural pursuits and protective habits of man and animals.

“ In the barbarous experiments to which I allude, animals bearing the strongest resemblance to man (at least in their conformation, for heaven, in its mercy, did not gift them with what we call mind) are usually selected amongst such as possess a heart with four cavities and double lungs.”

We would recommend Dr. Millengen to read our *brochure* on instinct, where we have endeavoured to show that all animals have, what is called “mind.” We humbly believe there can be no doubt about it. Consult WHATELY’S Logic.

But we must not waste time in taking up any further absurdities of our author. We have quoted sufficient to show that Dr. M. is not acquainted with the commonly acknowledged tenets in physiological science.

We return to Dr. Macaulay’s work.

“ If it should here be said that science ought never to be viewed in so grossly utilitarian an aspect as its immediate practical applications, and that the exercise of the faculties in search of truth, and the acquisition of science simply as such, are objects of sufficient magnitude to justify the means employed for attaining them, I reply, that

the cognitive must be ever subservient to the moral powers ; that knowledge must be ever subordinate to virtue. Science is falsely so called when it interferes with the principles of justice and humanity. Even the heathen philosophers admitted this :—"Scientia quæ est remota a justitia, calliditas potius quam sapientia est appellanda." The question of utility is here, therefore, neither irrelevant nor illiberal, with whatever contempt its proposal may be regarded, with respect to all the sciences where intellect alone is concerned."

We grant what our author has advanced, to be true, in the abstract. But let us bring this to bear upon *practice*, upon the daily concerns of life, because, unless it can be made practical, of what use are such faculties to their possessor ?

We hold that a purely moral man would be as dangerous a creature in society, as a purely intellectual one. What mischiefs, and discontents, and sins, would not a purely moral man bring upon himself and others, deprived of all intellectuality ; and again, what robberies and deaths, might not a purely intellectual man bring upon the community, if he were void of all morality ? We thus perceive the evil to be as great on the one side, as upon the other. In short, we must come to the conclusion, that no such individuals ever can exist in this world. Consequently, the cognitive and moral powers, must be mutual aids to each other ; there cannot be any superiority. To say that any man could be guided by either class of faculties alone, is to argue Nature into an impropriety, by giving to one man both sets of faculties, when it would have answered all practical purposes to

have furnished so many purely moral, and so many purely intellectual men, and what is as important, Nature would have saved much material by this arrangement.

Dr. Macaulay goes on to say that, the distinction which he has just pointed out, is generally overlooked. We have endeavoured to show that no real distinction can exist.

“ For we find physiologists, amidst all the multitude and variety of the facts which have been thus ascertained, often lamenting the unsatisfactory nature of their results, and complaining of the little light thrown by them upon the subjects intended. It was on this account that, although thousands of phenomena have been and may be observed and recorded, I stated that scarcely any important conclusions have been procured by experimenting on living animals.”

We purposely transcribe these sentences to show the feeble attempts to support an argument. Is not the doleful complaint which our author has sent out, the whining cry in the acquisition of all kinds of knowledge? Who is he that has placed one foot on the threshold of the TEMPLE of KNOWLEDGE, and has not felt the iron *breath* of difficulty, labour, and dissatisfaction? There is no “royal road” to this Temple! *but*, who is he that deserves the reward, who will not *force* his way to the glorious treasures that are within? This thought pleasantly recalls to our recollection the difficulties we have often experienced in passing within the great door of St. Paul’s Cathedral. What squeezing, and breathlessness we have most cheerfully borne for nearly two hours, on public occasions to gain an entrance to that Holy place.

And what is the Temple of Science but God's Holy Dwelling House? He who enters her porch, fulfils the highest end for which he was created by distributing her treasures to his fellow-men. There is no genuine Religion apart from Knowledge. Man's religion increases in proportion with his knowledge. He is the most religious, whose knowledge of the Universe is the most extensive.

We are insensibly led into this digression. It is a pity that an imperfection which applies generally, should be adduced as a negative in support of an argument. Our author appears to chime in with the hackneyed expression, "an illustration, however bad, in support of an argument, is better than no illustration at all."

Dr. Macaulay quotes the following passage from Dr. Barclay's work on the muscular motions:—"In making experiments on live animals, even where the species of respiration is the same as our own, anatomists must often witness phenomena that can be phenomena only of rare occurrence. After considering that the actions of the diaphragm, in ordinary cases, are different from its actions in sneezing and coughing, and these are again different from its actions in laughing and hiccup; after considering that our breathing is varied by heat and cold, by pleasure and pain, by every strong mental emotion, by the different states of health and disease, by different attitudes, and different exertions,—we can hardly suppose that an animal under the influence of horror; placed in a forced and unnatural attitude; its viscera exposed to the stimulus of air; its blood flowing out; many of its muscles divided by the knife; and its nervous system driven to violent desultory action from excruciating pain, would

exhibit phenomena of ordinary respiration. In that situation, its muscles must produce many effects, not only of violent but irregular action; and not only the muscles usually employed in performing the function, but also the muscles that occasionally are required to act as auxiliaries. If different anatomists, after seeing different species of animals, or different individuals of the same species, respiring under different experiments of torture, were each to conclude, that the phenomena produced in these cases were analogous to those of ordinary respiration, their differences of opinion, as to motions of ordinary respiration, would be immense."

Physiological science has made "rapid strides" since the days of Dr. Barclay. It is sufficient to observe that the function of respiration has been experimentally investigated by Sir C. Bell, Majendie, Legallois, Sharpey, John Reid, and a host of others. We have every reason to think and believe that Dr. Barclay would not have penned the above paragraph, had he been aware of the results of the above distinguished men. The "bloody" scene which Dr. B. has delineated, is no more than what happens "to the letter," upon the occasion of every surgical operation of any importance and danger. Indeed, we have seen human suffering more vividly portrayed, from life, than what Dr. B. has copied from experiments on the lower animals.

Dr. B. speaks of "the influence of horror," We have seen the same influence most painfully in action, in the human subject, while undergoing a surgical operation. I shall never forget "the influence of horror" (at the knife) which seized an unhappy patient previous to, and

during the performance of, a painful operation, which was performed in the Edinburgh Hospital, by my much respected preceptor, Professor John Lizars. The man's hair, to use the common expression, "stood on end," which too painfully showed the mental agitation, as well as the physical torture the poor fellow was suffering. The truth is, those writers who have said so much against studying Physiology, in the only proper way in which it can be acquired, would do well to inquire what daily takes place in our large hospitals, as well as in private life. Now, it would not be more absurd to argue, that a man, labouring under a painful and fatal disease, should not have his life saved by submitting to an operation, because, during the performance of that operation, he must suffer the greatest pain which it is possible to bear, than to say that physiology, or the study of phenomena should not be cultivated, by which we may acquire views of healthy and morbid changes, because the lower animals, the subjects of such inquiries, are the necessary and unavoidable sufferers. In the one case, the preservation of human life, is the object to be attained ; in the other, the knowledge of man in health and disease. Knowledge leads to the cure of disease, the destroying of which secures the prolongation of life, health, and human happiness.

We are not aware that it could be possible for anatomists to commit the egregious error which Dr. B. thinks it is possible they might.

Dr. Macaulay has quoted the opinion of the late Dr. Fletcher, who is against vivisection. He also states that Professor Alison "never finds it necessary to have recourse to such exhibitions in illustration of his lessons." This

statement is not strictly correct. During my attendance on the Professor's lectures, I have the most distinct recollection that a dog had been experimented upon, and the dead animal was carried round the class-room, that we might observe the mesenteric vessels loaded with chyle. More than this, Professor Alison has frequently been present and assisted Professor John Reid, of St. Andrew's, to perform experiments upon the lower animals.

I also attended the admirable lectures of Professor Reid in the Argyle Square School of Medicine, when the distinguished Professor repeatedly illustrated his subject by resorting to experiments on the lower animals. Professor Traill's opinion is also given, who is against experimental physiology. I should suppose that the learned professor cannot feel very comfortable when his opinion is placed against that of his colleagues, the late Sir C. Bell, Sir W. Hamilton, Professors Alison, Monro, and Christison; we are not sure but that we ought to add one or more of the same university to our list. Still more, several of the university's prizes have been awarded for these upon experimental physiology.

"It would be well if the better educated and humane members of the profession would, both individually and in their societies, openly discourage practices which are as much opposed to true philosophy as to true humanity." Dr. Macaulay adds the following in a foot-note:—"It has been recommended by some physicians, that these experiments should be prohibited by law, or at least permitted only under certain conditions. Dr. Bardsley, of Manchester, for example, proposed, that 'they might be instituted under the sanction of the

College of Surgeons or Physicians, in either of the three kingdoms, the individuals who wish to institute them specifying to these corporations the nature of the experiments, and their supposed advantages, ere they are permitted to put them in practice.'” Dr. M. adds the following to this suggestion:—“To any proposal of this sort we cannot assent, as we have no doubt that the good sense and good feeling of respectable physicians will soon induce them to unite in discountenancing cruelties by which at present the whole profession is disgraced.”

We are at a loss to divine what ideas Dr. Macaulay attaches to “true philosophy” and “true humanity;” therefore, we cannot comment upon that which we do not understand.

We cannot help thinking that Dr. Bardsley’s “zeal hath eaten up his wisdom;” certain it is that the doctor has entirely forgotten the respect which is due to himself and the dignity which belongs to the profession. The spirit which dictated our author’s suggestion is cold, contracted, and eminently calculated to injure the progress of science. Man is a free agent, and as such, is entitled and bound to act as he thinks best. But if Dr. B.’s suggestion were to be acted upon, he would forfeit his legitimate claim. But, independent of the insult which would be offered to every man of feeling and principle,—insult, because he had to ask permission to do what his knowledge and conscience dictated was right, necessary, and lawful,—the expense and inconvenience, of making such applications would materially lessen the practicability, and destroy all interest in the prosecution of original tracts of thought. I must say, notwithstanding the respect I bear to

Dr. Bardesley, from the position which he holds in the scientific world, that his suggestion is highly censurable by those who have the interest of their profession at heart.

As to the recommendation that experiments should be prohibited by law, we would reply, that the suggestionists either belong to that class of men who are two centuries in advance of the wise heads of the present day, or, they belong to the wits of Queen Elizabeth's time ; be this as it may, for we have not patience to enquire into so childish a subject, we will hear what a recent excellent writer, and late member of the Middle Temple says : " The profession of physic is at once useful and honourable. No body of men have exhibited more learning and general knowledge than the physicians ; while their intercourse with the higher orders of society, men of learning, and the public at large, has rendered them in powers of conversation, general intelligence, and gentlemanly manners, superior to all other professions." Such is the opinion of a late practical lawyer. We will compare this with D'Israeli's opinion, himself, a D.C.L., but not a *practical* lawyer, with which opinion, however, and in common justice to some of our personal friends at the bar, we must say, we do not altogether coincide ; " The truth is, lawyers are rarely philosophers ; the history of the heart, read only in statutes and law cases, presents the worst side of human nature." But, putting aside individual opinions, everybody admits that PHYSIC, in point of DIGNITY and UTILITY, walks arm in arm with DIVINITY. And, now that we are upon this subject, we would further venture to observe that, so far from the medical philoso-

pher condescending to ask the opinion and permission of law, it is the bounden duty, not only of law, but of the PARLIAMENT of Europe to give their most cordial encouragement and assistance to the efforts of SCIENCE and of ART. I wish I could say that our countrymen had, at any period of their history, done for us, what Italy, Germany, and France have done for *their* brethren. Two distinct colleges exist in our empire: the one, which forms more, much more than two-thirds of the community,—a college richly endowed, most slavishly encouraged; the other, few in number, poor, *shamefully* neglected, most pitiably requited. Yet, it is to the latter (and I speak it to their praise, in the same proportion, that I speak it to the shame of the former) that EUROPE *is* what she *is*. What good can come out of Nazareth, what can we expect from “that contemptible thing, a mere man of the world?” *Nothing! NOTHING!!*

A distinguished philosopher has said: “Intellectual nations are advancing in an eternal circle of events and passions which succeed each other, and the last is necessarily connected with its antecedent; the solitary force of some fortuitous incident only can interrupt this concatenated progress of human affairs.”

Were I as independent of fortune, as I am dependent upon her, I would here promise to devote two nights every week from the fatigues and pleasures of the drawing-room, four hours every day, (until my task was completed) from the pleasures of the chase, and the other *duties?* of the high bred nobleman, to show, that, at this moment, with all our discoveries and the pregnant prodigality of our authorship, to read which, as Lord Jeffrey *too truly* ob-

serves, "it would need a system of 'short-hand reading' to keep pace with them," we are rapidly advancing in that course which has been predicted. INTEREST, that destroyer, has taken the place of MERIT. Had merit the power, as it has the right, (to use Dr. Chalmers's simile in speaking of conscience) it would govern our scientific college, and we should be content and happy. It is not so. Our best and oldest institutions are falling from their primitive objects and original purity.

THERE IS BUT ONE REMEDY ! So much of the public money should annually be laid aside for the efforts of scientific minds, and the encouragement of the arts. The philosophic *spirit*, the mainspring of Thought, should be cherished and educated in all its purity ; the physical frame which embodies it should have worldly ease and security laid at its feet, and *the Spirit* should reign the noble and undisputed Lord of the Scientific College. Unless some such step be speedily taken, it is impossible to avert the impending and prognosticated danger.

It is lamentable to human thought, to be told that "It requires but little insight into man's heart to perceive that profession and professional advancement—that power and wealth—have a far more frequent and more effective influence on his judgment than any mental habits he may be supposed to have cultivated." *

Again : "Although unblemished candour, a vigorous understanding and a deep sense of moral propriety, have fallen to the lot of only a few, yet that man must have seen little, and reflected less, who has not perceived that

* Professor Babbage's Bridgewater Treatise, Preface, p. 16.

much of our creeds respecting philosophy, religion, and politics, is more frequently the effect of circumstances, habit, inclination, interest, and feeling, than of cool reasoning and dispassionate inquiry. Accordingly we find that the capacity for learning an art or a science is much more common than that of applying it to useful purposes; that many men have become learned who never could arrive at prudence and discretion; and that many have been ranked, on account of their talents, among philosophers, who, had they been estimated according to their wisdom, would have ranked very low in another scale of a different description.”* The corollary from all which is, that the efforts of science must *not* be checked by any worldly institution, call it what we may. Our feelings could dictate a volume on this topic; we have already said what will not be kindly received, and we may have injured ourselves in saying the little which we have said. “Such is Truth! men mistake her for a Gorgon, instead of knowing her to be a Minerva.” “Truth! thou fascinating, but severe mistress, thy adorers are often broken down in thy servitude, performing a thousand unregarded task-works!” Nevertheless, it is a consolation to *feel* and exclaim—*Magna est Veritas et prævalebit*.

So much then for our attempt to rectify a few of the general premises of the Rev. Dr. Chalmers, Rev. Dr. Styles, Rev. Dr. Drummond, Rev. Mr. Macaulay, and Mr. Youatt. We conclude this chapter by a few remarks which will equally apply to all the writers just mentioned.

The writings of our authors had one common object,

* Dr. Barclay, on Life and Organization.

viz., to suppress the many cruelties which, hourly, are being inflicted upon the brute creation. In which benevolent and philanthropic wish, they have succeeded in a manner that has secured to them the veneration and respect of the best and wisest of mankind. Each writer, however, has unhappily mixed in with the good he has done some alloy of evil. Each has committed the serious error of classifying the cultivators of medical science along with "those brutes in human form," who actually and continually torture those poor creatures which have been given for our use. They have overlooked, if they have ever known, the important law of our nature, that a lesser evil must be submitted to in order to secure a decided good. As we have already said, with as much propriety might they accuse the skilful surgeon of committing the worst cruelties, because severe pain is the unavoidable result of his benevolent endeavours for the sick. They have spoken of several of our first physiologists in language the most uncourteous and disrespectful; having often attacked them on grounds which were not more frivolous than they were erroneous, of which we have furnished the most unequivocal examples; in one word, I cannot cull from their joint voluminous writings one illustration which can be set up as a fair or logical proposition where upon to reason and decide so important a topic as that which forms our proper subject. It is impossible not to perceive the spirit with which they entered upon the inquiry of vivisection; they had not prepared their minds "for the reception of truth," by purging their sight (to use the figure of speech of Sir J. F. W. Herschel) with the "euphras and rue" which is necessary, "before we can receive ar-

contemplate, as they are, the lineaments of truth and nature." Nay, the very title of the chapter is sufficient to prove this position. Had not many members of our own profession committed the same error, we might have said that *Divines*, from the nature of their studies and mode of thought, were not capable of meeting our text at all. And in reality, we do think, they are not the class of persons who should venture to treat subjects of this nature. Religious philosophy is one thing, abstract philosophy, or the philosophy of *science*, is another. *Il faut dire, les physiologistes ne sont pas assez philosophes, et les philosophes ne sont pas assez physiologistes.*

Now, to discuss our question on purely religious grounds is only to treat it in part, and, therefore, to do it the greatest injustice. We must not be bounded by the Scriptural horizon, but we must bring to our aid, the whole extent of our knowledge, the several departments of which are the branches of the common trunk, and of which the three learned professions are the pruners and engrafters. None of our authors have stepped beyond the Scriptural horizon, and, what is more, most of the passages from the Bible which they have called to their aid, admit of a much more extensive range of signification, and could be very differently deciphered from what our authors have done. Were it in the least degree necessary for the purposes of my argument, I would undertake to give a very different, because much more comprehensive exposition of the text, "A righteous man regardeth the life of his beast," than our *joint* authors have done. To treat this text as our authors treat it is only to discuss one clause of it; in truth, the text just quoted,

admits of at least three other clauses, and forms one of the most admirably adapted arguments in support of *our own* position, of any with which we are acquainted. My readers will perceive that passages in Scripture admit of a philosophical explanation, as well as of a strictly ethical and evangelical exposition. For, whatever may be said to the contrary, we maintain that abstract and mixed philosophy form most important props to our religious faith. I would as soon think of pronouncing a man a physician because he was acquainted with the practice of medicine and physiology, as of holding that a man can be truly religious who is only acquainted with Biblical literature.

Anatomy is to the physician what philosophy is to religion. A man can never attain the dignity of a physician who is not generally, if not equally acquainted with the several branches comprehended under the term *physic*; no more can a man be properly religious who is not generally acquainted with the several elements and with the design of the universe. How can we reverence that which we do not know; *lip service* does not constitute the true worship of God. He alone *can* worship the Deity, who has made himself acquainted with, and whose heart and understanding *feels* and *sees*—

“Tongues in trees, books in the running brooks,
Sermons in stones, and good in every thing.”*

* “Time suggests to man the thought of eternity; space of infinity; law of intelligence; order of purpose; and however difficult and long a task it may be to develop these suggestions into clear convictions, these thoughts are the real parents of our natural religious belief. The only relation between true religion and the worship of the elemental world is, that the latter is the partial and gross perversion, the former the consistent and pure development of the same original idea.”—WHEWELL.

We have said that several members of the medical profession have committed the same error. This is a stumbling-block, and yet we must *not* be retarded by such obstructions. We will hurl them aside, and then our path will be as clear as though it had never been obstructed.

It is a curious circumstance, and the fact forms another CURIOSITY in medical literature, (I wish I could spare as much time as collect together all the MEDICAL CURIOSITIES, not physical preparations, but the emanation of men's brains, that I have met with in my sojourn in the medical wilderness; and I would present to the public the most valuable, and at the same time, the most *curious* multum in parvo, that ever found its way to a printer's office)—I say, it is a curious circumstance that, our literature affords no trace of the existence of a race of *Anti-Vivisectionists*, previous to the time of HALLER and HUNTER. And it is equally extraordinary that our profession was never studied on philosophical principles previous to the appearance of those IMMORTAL LIGHTS! We know that the physical and moral Universe teems with instances of the influence of attraction and repulsion, and of love and hatred; and we have as many instances in the intellectual world of progression and retardation, as if it were possible for the inhabitants of our globe to know too much, or to learn too quickly.

We have answered the principal objections which have been started by those of our profession, who are *Anti-Vivisectionists*; but, as we have already said, they would have done themselves more justice had they left untouched a territory, of which Haller, Hunter, and many

others, are the rightful occupants, than they will do by endeavouring to make inroads upon it and impoverish it by their feeble and futile attempts.

It will be observed that in this Chapter I have not taken up the remaining arguments of Dr. Drummond and Mr. Youatt, for the very good reason, that they, and indeed all the other writers, have employed the same objections, and frequently the same illustrations, so that to do so would be to go over the same ground we have already ploughed. Did we not know otherwise, we might accuse one author of having copied from the other. But the explanation is ready and most satisfactory.

Our authors had only a small circle, within which they could work, which circle was divided and subdivided into few compartments; consequently, if each fulfilled his task by using these arguments best adapted to strengthen his fortification, they must necessarily employ the same logic and consequently appear to copy from one another. All have adduced *Celsus* as their strongest support. We maintain that *Celsus*, when placed in the scale with *Vesalius*, *Albinus*, and many others, is but as a feather, the mere shadow, not the substance of an authority. They have misplaced *Celsus* together. It would not be more absurd to place the opinion of a practical gardener in this country on the best manner of rearing the *Tea* plant, against that of the man in China who had spent a long life-time in rearing that shrub.

These general observations conclude the second part of our work.

PART III.

CHAPTER I.

WHAT IS ANATOMY and PHYSIOLOGY?

I cannot do better than quote the very apt definitions of that eminent physiologist Dr. SHARPEY* :—" Whatever relates to the configuration, the structure, the position, and the connection of the organs,—in a word, all that concerns the mere structure of the body, belongs to *anatomy*. The living actions or functions of the body, and its vital properties, form the subject of *physiology*. Thus, for example, when we examine the outward form of the heart, or the configuration of the cavities contained within it, the nature of the tissue of which it is composed, its situation and its connection with other parts in the chest, we are engaged in the study of *anatomy*. But when we enquire into the phenomena which are manifested by this organ in the living body, its incessant motion,

* Professor Sharpey's Introductory Address, delivered in the University of London, Oct. 3, 1836.

the manner in which it propels the blood in a perpetual circuit, or the remarkable property on which its motion depends, our enquiry belongs to *physiology*."

From the above definitions, and the remarks which have preceded them, we perceive that anatomy and physiology hold the same inseparable relation to each other that *effect* does to *cause*.

M. MAJENDIE has admirably expressed himself on this subject :—" We are all capable of practising common anatomy ; in fact, nothing is more simple, or more easy ; you require some care, a little time and patience, with a certain quantity of manual dexterity, and you become a good anatomist ; but when we have to study the structure and functions of the living animal, that is to say, study living anatomy, a host of difficulties spring up ; some men experience an invincible repugnance to the performance of experiments on living animals, in the same way that some surgeons have been compelled to abandon a profession for which they were ill suited, through an insurmountable repugnance to the performance of any operation on the living body."

M. Majendie, in his Lectures, published in the *Lancet*, has the following very important passage :—" All these facts were unknown before the experiments which I performed to determine the existence and seat of the cerebro-spinal fluid. COTUGNO, however, whose name has been rendered celebrated by the discovery of his fluid in the internal ear, had also made some experiments, relative to this phenomenon, on the dead body ; but his observations are completely lost in his work on 'Sciatic Gout,' in which he published the result of his anatomical researches

on the membrane of the brain. In the work just mentioned, we find the pressure of the fluid in the dead body established; an accurate description of the manner in which the envelopes of the nervous centres are disposed; and, finally, the incontestible fact of the fluid being most abundant in aged persons; with several other highly interesting observations. *COTUGNO* asks, whether the fluid really exists during life, or is a cadaveric phenomenon? but he arrived at no determinate conclusion upon this point. I was totally ignorant, Gentlemen, of all I now tell you when first I undertook my experiments on the cerebro-spinal fluid; but even supposing I had cognizance of the researches made so long ago by the Italian anatomist, it would remain equally true that I was the first to determine its existence by direct experiment. The manner in which my attention was first directed towards this fluid was very simple.

“While making a number of experiments on the anterior and posterior roots of the spinal marrow, I perceived that each time I made an incision into the dura mater, a certain quantity of fluid escaped. Thus, you see, without going any further, how this fact was discovered by studying anatomy on the living animal; other facts were joined to that just mentioned; they may be arranged in the following succession, or order, for the sake of clearness, and to render our demonstration more evident:

“The first phenomenon is, that, on laying bare the dura mater on the living animal, we perceive a tumefaction and subsidence of that membrane alternating with one another.

“The second phenomenon is the tension which the cerebro-spinal fluid causes in the sac of the dura mater.

“The third fact is the issue of fluid in a kind of jet, when the membranous sac is opened.

“The fourth fact consists in the hernial protrusion of the arachnoid through the opening in the dura mater.”

We transcribe the following from M. Majendie's 12th Lecture, detailed in the *Lancet* for 1836 :—

“The branches of the fifth nerve are extremely numerous ; hence, from the very brief enumeration we have already given, you may judge of the very great variety of parts which it supplies ; indeed, this nerve alone has formed the subject of several distinct treatises, in folio, quarto, &c. SOEMMERING and MECKEL were the first who followed with great care all the smaller filaments of the trifacial nerve, yet neither anatomist drew any useful conclusions from his researches. An experiment, made by Sir CHARLES BELL, demonstrated that the motion of closing the eyelids is destroyed by the section of the facial nerve. I have frequently repeated this experiment, and found it perfectly exact. As soon as you divide the trunk of the facial nerve in an animal, the latter loses the power of closing its eyelids, the eye-ball remains constantly exposed to the action of the air, the animal no longer winks, either spontaneously or when a foreign body is brought into contact with the conjunctiva. Thus you see experimental physiology demonstrating a fact which could never have been discovered by the mere anatomist, and establishing a line of demarcation between nerves with respect to their sensibility. We shall examine this fact on the living animal before you, and show you the difference existing between the sensibility of the facial nerve, and that of the fifth, in the most striking manner.

“ [Here the Professor took a young rabbit, and made an incision into the skin, over the course of the facial nerve, observing that it was very easy to be found in these animals, as the divided parts furnished so little blood.]

“ Here (said the Professor) is the trunk of the seventh pair ; you see how easy it was to lay it bare. Before I proceed to cut it, let me draw your attention to the fact, that the integuments of the animal's face are highly sensible, and particularly in the parts to which the branches of the seventh pair are distributed. Now, by pinching or cutting the nerve we can determine directly, whether it is really endowed with sensibility or not. You see how I pinch and irritate the nerve without developing any very great signs of suffering ; in fact, its sensibility seems almost null.

“ Here, then, we have a nerve taking its origin in the brain, and distributed to the face ; yet it is evidently not the agent of sensibility. Pay attention to this fact, Gentlemen ; it is one of the first I have had the honour of showing you, and may well contrast with the conjectures of our more brilliant, but unsolid physiologists.

“ We said that the face was principally supplied by two nerves ; we have shown that one of these nerves is little, if at all, sensible ; hence a natural conclusion, that the other, or nerve of the fifth pair, is the one destined to supply the parts with sensibility. This reasoning, however just and logical it may appear, is not sufficient ; we have more conclusive evidence, and must produce it ; experiment must determine the question for this nerve, as it did for the facial one. Sir C. Bell performed this experiment, and divided the branches of the fifth nerve, as they

pass out from the supra-orbital and sub-orbital foramina, and from the sub-mentar hole. We thought it right to modify this experiment, and instead of operating the section of the nervous branches not far from their termination in the integuments of the face, we endeavoured to make an experiment more perfect, and less subject to the influence of any disturbing causes, by dividing the trunk of the nerve, within the cavity of the skull, just as it leaves the pons varolii. By operating in this manner we shall obtain general results more exact and free from error than Sir C. Bell could have obtained by the division of a single branch.

“It is not a matter of very great difficulty to divide the trunk of the fifth pair of nerves in a living animal. If you are well acquainted with its traject in the particular species of animal on which you propose operating, you can introduce a triangular shaped cutting instrument into the middle temporal fossa, just over the trunk, which you cut across by simply depressing the instrument near the place where the nerve separates itself from the brain. I should, however, direct your attention to the fact, that the fifth nerve runs close upon some of the venous sinuses, and if you introduce the instrument in such a way as to wound one of those venous recevoirs, or, perhaps, the trunk of the internal carotid artery, your experiment must naturally fail. Hence you see, that though our method of practising the experiment has the advantage of being followed by more certain and general results, it is much more difficult than that of Sir C. Bell.

“You know whether you have divided the nerve or not, by the movement in totality of the animal’s body, the moment you cut the nerve.

“[Here M. Majendie introduced a sharp-pointed cutting instrument into the cranium of a rabbit, and probably divided the nerve at the first attempt, for the animal gave signs of acute suffering, by a general muscular effort, when the handle of the instrument was elevated.]

If (resumed the Professor) the animal retain any sensibility on the side of the face corresponding with the nerve now divided, you may conclude, to a certainty, that the section has been incomplete. However, let us see. [The trial was here made.] The experiment, gentlemen, has been perfectly successful. I touch and pinch, as you may observe, various parts of the animal's face, the nose, the lips, the surface of the eye-ball, &c., and the animal does not evince the slightest trace of sensibility. Hence the physiological conclusion to be drawn from the section of the fifth nerve, which I have performed before you, is, that this nerve presides over the function of sensibility in the face. When this has been demonstrated in so direct a manner, we have no necessity to recur to induction. However, I may mention, that experiments made with galvanism on the nervous system tend also to show, that the insensibility of the parts of the face in man depends on a lesion of the fifth pair of nerves ; hence, during hospital, or private practice, whenever you observe any particular portion of the face, the conjunctiva, for example, to be insensible, you well know to what particular nervous branch your remedies should be directed. Should the seventh nerve be the one injured, the face still preserves its sensibility.”

I proceed now to detail one or more experiments by PROFESSOR JOHN REID, of St. Andrews ; the bare men-

tion of whose name as a cultivator and *discoverer* in physiological science will speak volumes for my task, and, happily for me, will amply make up for the many imperfections on my part in endeavouring to advocate the interests and vindicate the character of the EXPERIMENTAL PHYSIOLOGIST.

The reader may consult the several papers by Dr. J. Reid, in the *Edinburgh Medical and Surgical Journal*, from which valuable repository I select the following.

“ *An Experimental Investigation into the Functions of the Eighth Pair of Nerves, or the Glossopharyngeal, Pneumogastric, and Spinal Accessory.*”*

“ The Eighth Pair are undoubtedly the most interesting and important of all the nerves of the body, both in a practical and theoretical point of view. Their lesions are attended by the most serious derangement of the respiratory and digestive processes, and bear in a prominent manner upon some of the principal doctrines in physiology. The functions of these nerves have, therefore, commanded a more than ordinary degree of attention, and the industry and talent of numerous observers have been directed towards their elucidation. In entering upon an experimental investigation into the functions of the three divisions of this pair of nerves, I was fully aware of the numerous difficulties attending such an undertaking, and have endeavoured to approach it with all the circumspection and assiduity which its importance and inherent intricacies require. I, nevertheless, feel very considerable

* A short epitome of this paper was read at last year's meeting of the British Scientific Association. See *Edinb. Med. and Surg. Journ.* for Jan. 1, 1838.

diffidence in presenting the first results of this inquiry to the public, since the data which I have obtained will necessarily lead me to draw several important inferences regarding the functions of these nerves, at variance with those entertained by many of the most celebrated and experienced practical physiologists. And most persons feel disposed to receive with caution, or even distrust, the observations and opinions of one who can scarcely be said to have finished his noviciate in the difficult task of unravelling the operations of the complicated machinery of the higher organized bodies, and the more especially when a considerable part both of his premises and inferences are in opposition to those promulgated by physiologists, whose years and well-earned fame, acquired by their long and laborious exertions in the extension of this science, entitle their opinions to the highest credit. Being confident, however, from my previous pursuits, and from the great care with which I conducted, after their death, the dissections of all animals operated upon, that I could not possibly be mistaken as to the particular nerves upon which the experiments had been made; profiting largely from the recorded errors and instructions of those who have preceded me in this field of inquiry; and taking the very necessary precaution of making a careful repetition of the experiments under varied circumstances, so as to avoid as much as possible any accidental sources of error, I have been encouraged to publish the results thus obtained,—being satisfied that the facts will be found, upon actual examination, such, or at least nearly such, as I represent them. In entering upon this investigation I had no favourite theory to defend, stood committed to no pre-

conceived notions, or shackled by any slavish deference to authorities, but was ready and willing to give up any of my former opinions as soon as they appeared to be inconsistent with the phenomena which presented themselves ; and I sincerely hope that I am not chargeable with the opposite and equally dangerous fault of seeking and hankering after novelties.

In stating the experiments, I shall enter more fully into the details than many may think necessary, as it appears to me that it is an object of essential moment to mention all the circumstances under which any important experiment is performed in physiological investigations, where so many extraneous circumstances are apt to interfere with the results ; and I am convinced that if this plan had been more fully followed, many a controversy might have been avoided, as well as much animal suffering spared, and the science would this day have presented fewer discordant statements, and less unfortunate collision of opinions. It may appear to some that I have repeated many of those experiments with unnecessary frequency, and a wanton sacrifice of animals. But I naturally felt diffidence and distrust in the accuracy of the results which I obtained when opposed to those of more experienced observers, and it was only after repeated and careful examination of the phenomena, that I could feel myself justified in calling these in question. It is also sufficiently obvious, that nothing is more injurious to the progress of science than hasty and partial observations ; and I was anxious to avoid, as far as I possibly could, adding to that mass of conflicting evidence, which there is already so much reason to deplore. Besides, as every false obser-

vation requires additional experiments for its refutation, I felt that, with less extended opportunities of witnessing the phenomena under examination, I must incur a greater risk, not only of throwing obstacles in the way of the progress of truth, but also of occasioning a useless infliction of animal pain."

I purposely transcribe these introductory remarks to Dr. Reid's very elaborate paper, that the general reader may form his own opinion of the character and motives of the professor, and that he may point out for himself the striking contrast which obtains between the *real* character of the experimental physiologist, and that drawn by those who are against this method of inquiry.

For the instruction and satisfaction of the non-medical reader, I will transcribe experiments 4th and 5th.

"*Exp.* IV.—The glosso-pharyngeal nerve was first exposed on one side, and then on the other, in a middle-sized terrier. Very forcible convulsive movements of the muscles of the throat and lower part of the face, but more especially of the throat, were observed on pinching these nerves with the forceps. On cutting the nerve across, the same convulsive movements and indications of suffering were noticed on pinching the nerve on the proximal end, or that part of the nerve which retained its natural connection with the *medulla oblongata*. These convulsive movements were exactly similar to those observed when the nerve was entire. There were no convulsive movements on irritating the lower end by the forceps.

"*Exp.* V.—The nerve was exposed on one side in a middle-sized full-grown pointer. When irritated by pinching it firmly with the forceps, only very feeble convulsive

movements of the throat were excited, and such as would readily have escaped notice, had we not been in search of them. Professor Sharpey, of the London University College, was present from the commencement of this experiment, and as we were proceeding to expose the nerve of the opposite side, we were joined by Professor Alison. On irritating the opposite nerve by pinching it with the forceps, the convulsive movements of the muscles of the throat were distinctly marked, but still in a less decisive manner than in some of the preceding experiments. The nerve was then included firmly in a ligature. On irritating the nerve on the proximal side of the ligature, the same convulsive movements followed; while no effect was observed from the irritation of the nerve, on the distal side, or that in connection with the tongue and pharynx. The same difference in the results was also obtained from the irritation of the two ends of the nerve when cut across. We had in this dog an opportunity of contrasting the manner in which muscular movements are induced through the stimulation of a motor nerve, such as the hypoglossal, or the spinal accessory, with that motion which results from the excitation of a sensation, as appears to be the case when the glosso-pharyngeal is irritated. For while the stimulation of the ~~hypoglossal~~ and spinal accessory on the distal side of the ligature was followed by convulsive movements of the muscles to which they are distributed, and of these only, the stimulation of the glosso-pharyngeal on the same side of the ligature produced no visible effect. On the other hand, irritation of the ~~pyro~~ ^{pyro} ~~glossal~~ ^{hypoglossal} and spinal accessory on the proximal side of the ligature excited no muscular movements whatever, while

hypoglossal

pyro hypo

excitation of the glosso-pharyngeal on this side was followed by extensive movements in muscles, to the greater part of which it sends no filaments. When the glosso-pharyngeal was pricked with the forceps, the indications of suffering were distinctly but not strongly manifested, but the application of a tight ligature was evidently attended by intense pain,—an effect which we were somewhat surprised to find also attended the application of a tight ligature to the hypoglossal. A fatal dose of prussic-acid was given, and the muscles of the throat more fully exposed, when distinct convulsive movements of the constrictors of the pharynx were observed each time that the pharyngeal branch of the par vagum was pricked.”

The next book before me is the original, and, to the scientific promoter of Medical Science, the very valuable monograph of Dr. SAMUEL WRIGHT, of Birmingham. PROFESSOR CHRISTISON, of the University of Edinburgh, has given the following as his opinion of the character and value of one of Dr. Wright's Investigations in Experimental Physiology, and its application to the PRACTICE of Medicine, and consequently to the cure of disease:—“Among these I may particularize his Inaugural Dissertation, not yet published, on the Action of Mercury and some of its compounds, as being in my opinion, not merely the best of the Prize Dissertations produced last year by the graduates of this University, but as likewise, one of the most important contributions that have been made for many years past, to the store of medical knowledge in chemical pathology, the doctrine of general therapeutics, and the physiological action of poisons.”

I will further give the opinions of two distinguished individuals who have availed themselves of Dr. Wright's inquiries into the physiological action of *Ergot of Rye*, reprinted from the Edinburgh Medical and Surgical Journal, vols. lii. and liii.

“Dr. J. Y. Simpson, Professor of Midwifery in the University of Edinburgh, very kindly tried the oil of ergot, and his opinion of its efficacy is thus expressed, in a communication with which I was recently favoured by him. ‘I have repeatedly employed your preparation of the ergot, and have always preferred it of late, because it has appeared to me to act with more precision than the infusion of the powder, and its dose is more easily regulated. I have used it, both in cases of lingering parturition, dependent on deficient uterine contraction, and also in instances of *post partum* hæmorrhage. In one case of the latter, where the uterus relaxed, again and again, after the repeated introduction of the hand into its cavity, I gave your preparation in a large dose, (sixty drops and repeated,) and very shortly afterwards the uterus began to contract firmly, and the woman, who was much reduced by the flooding, complained of the severity of her after-pains.”

“M. Meisser, of Paris, to whom I sent a quantity of the oil, observes respecting it:—‘I am much pleased with your preparation of ergot. I think it superior both to the infusion and the tincture. It has all the advantages, without the inconveniences of the former. It is easily regulated, does not offend the stomach, and operates with quickness and certainty. Since receiving your kind communication on the subject, I have employed it

constantly, and it has ever equalled my desires. I have also recommended its use to many obstetricians, and they have found it most serviceable."

In what has preceded, we humbly conceive that we have *amply* shown, not from our own experience, for, whatever may be the extent of that, we have purposely kept it at rest, but from the recorded observation and Medical Experience of those who have "a name and a habitation," in the *Book* of SCIENCE.

We purpose now briefly to consider the relation which Structure bears to Function ; or, in other words, to offer a few remarks on the Phenomena of what is termed the 'healthy animal body.'

The distinguished MULLER has the following sentences in the commencement of Book the Sixth, of his most valuable work, which I shall take as a text, and upon which I shall build a few reflections.*

"The organism and the piece of artificial mechanism resemble each other in the well-adapted combination of their several parts for the production of a general result ; but the organic body is distinguished by the power of reproducing the mechanism of its own organs, in the form of germ, and of thus propagating itself. Again, not merely does the action of organic bodies depend on the harmony of their component organs, but this harmony itself is an action of the organism ; while the cause to which each part of the organized system owes its state and properties resides not in itself, but in the cause which produces and maintains the whole."

* See the English Translation by the learned and indefatigable Dr. BALY.

Thus, then, we may say that *structure* holds the same relation to "artificial mechanism," or physical matter, that *function* does to "organism," or the action and mutual co-operation of one organ upon another, the sum of which constitutes the LIFE of Animate Nature.

Now, life, or living action, is that "something" which originates function from structure. Function being "the result of structure—not structure of function, or of any view of function."

How, then, can we best study the phenomena of health in the animal body?

The word "health" is a relative term, as are heat, cold, and some other words. Now, we may fairly question if the human body is at any time in a perfect state of health; because, although we may feel "perfectly well,"—each of us from our earliest period of life to our final existence in this world, not only constantly carries about with him the seeds of disease, but, some of these seeds are in constant growth upon one organ or another, although imperceptible to our common feelings. Such being *strictly* the case, we must be content to study the phenomena in our mental and animal body as we find them, not as we designate them. I have already said that we cannot study the phenomena, or functions of organs in inanimate matter, or by human and comparative anatomy. Human and comparative dissections can alone teach the structure of man and animals; to study function we must have recourse to human and comparative *physiology*.

The anatomist dissects off the skin, fascia, and muscle, and he opens the chest. What does he see? what action does he study? None. Muscle, heart, liver, what-

ever be the part under examination, is *lifeless* matter, as much so as a section of any part of the machinery of a steam engine. The products of the laws of chemistry are to the action of a steam carriage what life is to the structure of organized bodies. What can be more explicit, more simple of comprehension ! But more, mere human and comparative anatomy are insufficient to teach even the correct nature of structure. Until a very recent period, the anatomists of this country had been pursuing but a very vague and unsatisfactory method in their inquiries into the nature of structure. To use the words of a very talented and laborious physician,* we must “reform the first elements of our scientific education.”

I take the liberty to quote the following paragraphs from Dr. Bennett’s address :—

“The notion of most men respecting the skin is, that it is composed of epidermis, rete mucosum, and cutis vera. But it was by means of the microscope that Breschet, Vauzème, Gurlt, Simon, and others, discovered its real anatomy, and showed us the existence and relations of the papillæ, of the sudorific organs and their ducts, the inhalent and mucific apparatuses, and so on. All our knowledge of epidermic structures also, such as hair, horn, feather, &c., may be said to have originated in the use of the microscope.

“In the same manner the real structure of cartilage, bone, tooth, tendon, cellular tissue, and, in a word, of all the solid textures, has been revealed to us,—so that it

* See Dr. Bennett’s Introductory Address, to a course of Lectures on “The Employment of the Microscope in Medical Studies.”—Edinburgh, MacLachlan and Co., 1841.

may be truly said, that our real knowledge of structural anatomy, and all our acquaintance with the true composition of every organ in the body, has been arrived at by means of the microscope, and would never have been known without it."

Consequently, we cannot agree with the eminent Mr. LAWRENCE when he says:—"Anatomy is the sign of healthy structure."

We perceive, then, that microscopical anatomy is to the study of structure, what we shall endeavour to shew vivisection is to the study of function.

We will go a little into detail and take as our first illustration, the function of absorption.

The question is still *sub judice*, what vessels carry on absorption?

"*Do the capillaries absorb?*" "But it required a long course of experiments to establish the fact of the immediate absorption of matter into the blood without the aid of lymphatics. Majendie, Emmert, Mayer, Lawrence, Coates, Tiedemann, Gmelin, and Westrumb, have particularly distinguished themselves in this inquiry.

"Delille and Majendie divided all the parts of the thigh of a dog except the crural artery and vein, leaving merely these vessels, which were dissected quite clean, and freed from their cellular coat, to maintain the connection of the limb with the trunk; two grains of a strong poison (the upas ticuti) were then inserted into a wound in the foot. The action of the poison was as rapid as if the limb had been previously uninjured. The symptoms began to show themselves in four minutes, and in ten minutes the animal was dead."

Here follow a series of experiments by the above gentlemen, and several others, which it would serve no purpose to detail.

I pass over several pages of Müller's work (from which the above is transcribed) and I come to the following :—
" Time required for absorption by the capillaries.—I wished to know the time required for any substance to reach by the way of imbibition the superficial layers of the capillaries of a part which is not invested by epidermis, so as to enter the circulation.

The delicate membrane which forms the villi of the intestines in the calf and ox, contains capillary blood-vessels, although the villi themselves measure only 1-530th of an inch in diameter. From this measurement we can conceive to what depth fluids must permeate to reach the capillaries of any membrane free from epidermis. Having put into a glass vessel with a very narrow neck some solution of prussiate of potash, I tied over it in one experiment the urinary bladder of a frog, in another the lung of the same animal, then with a hair-pencil applied to the surface of the soft membrane some solution of a salt of iron (the muriate), and at the same moment inverted the glass, so that the solution of prussiate of potash came in contact with the inner surface of the membrane. A second of time had not elapsed when a pale blue spot formed and soon became more distinct. It appears, therefore, that substances in solution permeate a membrane of the thickness of the stretched bladder of a frog in detectible quantity within a second of time. We may therefore safely admit, that substances in solution permeate in detectible quantity a membrane not covered by epidermis,

so as to reach the first layer of capillaries, and thus to enter the circulation in a shorter time than a second."

In like manner we might enter upon and detail the many experiments which have been performed on the *Absorbents* ; of Eberle, Schwann, and a host of others, on *Digestion* ; of M. Edwards, &c., on *Animal Heat* ; of Poiseuille, Sir A. Cooper, &c., on the *Arteries* ; and of Laennec, Majendie, the British Association, Legallois, Wilson Philip, Marshal Hall, &c., on the *Sounds of the Heart*. Not to enlarge upon the present list, we would respectfully direct the reader's attention to several papers on *Animal Physiology*, in the Transactions of the Royal Societies of London and Edinburgh ; of the Medico Chirurgical Society of London ; and of the other valuable medical periodicals of the day, in our own country, and foreign parts.

So much, then, for EXPERIMENTAL PHYSIOLOGY in the study of FUNCTION.

CHAPTER II.

HITHERTO we have but spoken of the phenomena or functions of the animal body in health. We shall now briefly inquire into the action of the human body in *disease*.

By disease, we understand that, one or more organs or parts of the human body is in an abnormal condition; in other words, that the *harmony* which pervades the phenomena momentarily going on within us, is more or less disturbed and destroyed.

This brings us to consider the *modus operandi* of medicines on the human body, termed Therapeutics, and the Practice of Medicine, in man; Veterinary Medicine and Surgery in animals. The appearances present after death; the pathology of disease.

The grand object of medical treatment is to remove the disease, and restore the healthy balance of the constitution. Which object can only be effected by the administration and the *modus operandi* of medicines.

Now, what concerns the physician is to *ascertain* the effects of his remedies upon diseased action ; not only so, but to proceed a step further and inquire what particular effects particular remedies may have upon the lower animals, by which he may avail himself of the rich field which *analogy*, the striking analogy, which obtains between the mental and corporeal structures in man and animals, opens to his view. A particular result follows the administration of a particular remedy in a lower animal ; what is the *ratio* of the probability which we may expect to find upon administering the same medicine, under precisely the same circumstances to a human being ? This is the *questio, questionum !*

We may ask, upon what is the PRACTICE of Medicine founded ? The answer is, OBSERVATION and EXPERIMENT. What is the practical physician, or the practical surgeon, but an *experimentalist*. “*Experior*,” “I try,” “I attempt.” I am called in to visit a sick bed. What do I do ? I endeavour to ascertain the disease, and I *try* to cure it. I give a series of remedies ; some are useful, others are prejudicial. Can I be sure of the success of any remedy which I may employ ? Is the science of medicine an infallible science ? Are there not many diseases, the progress of which we cannot controul ? But are we on that account to remain silent spectators of a scene, which, so to speak, is tearing so many chords of the best feelings of our nature ? Surely not ! Are we not called upon to *alleviate*, if we cannot remove disease ? and how can we alleviate it unless we *try* so to do ? The corollary from which questions, then, is, that the practical medical man is *toto cælo*, an experimentalist.

Veterinary Medicine and Surgery!—This profession does honour to human nature. What is implied by it? That the lower animals are mentally and physically constituted as ourselves, a question, no doubt of *degree*, but not of *kind*.

The subject of ANALOGY is again forced upon our attention. And what has the medical man to do with *Analogy*? Everything! Consult Mr. YOUATT's work on "Humanity to Brutes," and "*The Veterinarian; or Journal of Veterinary Science*," edited by Mr. YOUATT, with the assistance of PROFESSOR DICK and Messrs. KARKEEK and PERCIVALL. In these valuable repositories we have a full code of medicine and surgery, for the benefit of those self-helpless, but useful and noble creatures, the handiwork of God! What is our argument for the truth and usefulness of the analogy above implied, viz. That veterinary medicine has *proved* to be one of, if not the most valuable, aids to the investigation and cure of disease in man. What more striking argument could be adduced, what better proof could we require?

Pathology.—Our patient dies, and we painfully, but conscientiously fulfil the last duty imposed upon our profession by taking up the scalpel and endeavouring to trace the many phases which the disease has run, to ascertain its nature, and to profit by the new facts which may be presented for our consideration. The professor of veterinary medicine performs the same duty; we study the *analogy* which obtains in the morbid texture of man and animals, and we present the new facts which have been carefully arrived at by observation, and apply them to the benefit of those sick persons who next are entrusted to our care.

Such, then, is a brief but correct outline of what *analogy* has already done, and what we have yet to expect from it.

It would be foreign to my purpose to enter into detail; we refer our reader to the several works on the subject, and would assure him that in the above references he has a mass of facts and arguments, which the stoutest sceptic would in vain assail, and to refute which would not be more impossible than that “a camel should pass through the eye of a needle.”

CHAPTER III.

WE anticipate our reader in thinking that his attention will now have become fatigued by considering the "*mass of facts*" which we have adduced, and that he will feel disposed to say, "I wish the author would give us the *application* of the argument."

We shall now fulfil this request, previously giving a very general explanation of the notes in the appendix from numbers (6.) to (20.) inclusive.

(6.) Then, is the preface in full of BRACHET. The reader will learn for himself the motives of the author in performing his many experiments, upon which the candid mind will place a very different construction from what have been ascribed to that distinguished physiologist.

(7.) Will give an idea of the difficulties under which the ancients laboured, in prosecuting Medicine and Surgery; shewing, that they were not permitted to dissect the human body, but had to draw all their knowledge from the

inferior animals, which necessarily has proved to be very erroneous, because they were not permitted to trace the gradations in the analogy which exists between man and animals.

(8.) We cannot but lament that the same assistance and encouragement is not now given to the scientific portion of our profession which was so freely and nobly bestowed upon HARVEY by CHARLES THE FIRST.

(9.) It cannot occasion surprise that so little allusion has been made to LORD BACON in the writings of those who differ from us in opinion. It behoved them to treat such authority as though it had never existed. It may be said that Bacon was not a practical medical man ; but he was a medical philosopher, as much as a physical philosopher ; in short, his comprehensiveness of intellect enabled him to grasp at the several *branches* of Science and reason upon them as a grand whole. Surely, it will be admitted that no man ever lived who was better qualified to form an opinion on our proper subject, or one whose recommendation we should more religiously abide by and venerate. How, then, has it come to pass that our opponents have set at nought the advice of Bacon ? They should, at least, have canvassed his opinion !

(10.) Is the opinion of a very eminent literary man. It is of the highest importance to possess the opinion of men of acknowledged celebrity in their particular departments, because, we may be assured that it is candid and unprejudiced.

(11.) Our remarks on Lord Bacon will equally apply to Sir C. WREN ; besides, Wren, himself, was an Experimental Physiologist.

(12.) The HON. ROBERT BOYLE's views are very remarkable. They merit the best consideration from all candid men.

(13.) Philosophical moderation and the meekness which enoble our better nature, characterize the remarks of Mr. SAUMAREZ.

(14.) Furnishes a very good example of *accident* originating a discovery. The experimentalist's object was to demonstrate the recurrent nerves, and his observation detected the chyloferous vessels. The error into which he fell cannot surprise us.

(15.) Dr. COMBE's opinion of the importance of some of Brachet's experiments. Our opponent's castigation of Brachet furnishes a remarkable instance of the perversity of the human mind in reasoning upon *particulars*, on a question which only admits of the most extensive bearing.

(16.) We would respectfully offer the example of the illustrious BOERHAAVE to the ingenuous student and to the man of science.

(17.) The celebrated Dr. HUNTER was imbued with the *proper* Spirit. It is unaccountable to see men setting at nought the precept and *example* of the wisest and greatest in our profession. Many of the processes of thought and action of the human mind contain more *within* them than has yet been gleaned from our *present* philosophy. We are almost tempted to ask if we have yet hit upon the right method of studying the operations of MIND. Be this as it may, Dr. Hunter has set an example, which all right-minded men would do well to imitate.

(18, 19, 20.) We cannot but feel some self-satisfaction in advocating a cause when we are backed by the high authority of Dr. James Johnson, and the Editor of the *Lancet*. Every candid mind will rightly appreciate their exertions in behalf of Science and Humanity, and last, though of as great importance, the carrying down the veneration and the beloved memory of the illustrious departed to their successors.

RECAPITULATION.—We have, then, laid before the reader a great variety of FACTS, and we have endeavoured to quote passages (being little concerned as to their length) which will enable the non-medical reader to consider the subject for *himself*, and to form *his* own opinion. We have adduced authority, which for weight and importance we humbly believe to be unparalleled, on any former occasion, in defence of an argument, and we hold in reserve treble the amount we have brought forward, should they afterwards be necessary. If, then, Facts, Authority, Experience, and Practical Observation and Experiment are to continue to have that *place* which they have hitherto held, we claim for them a hearing in the present defence of EXPERIMENTAL PHYSIOLOGY.

CHAPTER IV.

APPLICATION of the Argument.

When we look abroad upon External Nature, and consider the relation which man holds to it, while we acknowledge that he possesses certain powers and capabilities over himself, his fellows, and the endlessly diversified forms in which animate matter is presented for his use, we also *feel* that he is not Lord of all, and that he is subject to a higher power.

We thus trace the chain of gradation from the Deity to man, from man to the lower animals, and from him and them to the world we inhabit.

Each link, then, of this chain, holds an assigned rank, and possesses a power peculiar to itself.

Now, it is the relationship which holds between man and animals with which we have to do, and we shall not, therefore, overstep our legitimate boundary by considering the others.

We set out with the proposition that a *strict* and *defined* relationship does exist between man and animals, or, in other words, that their mental and physical organization is only a question of degree, not of kind.

We maintain, then, the existence of MIND in *all* living creatures, and we divide the terrestrial world into two grand divisions,—Mind and Matter.

Now, what is *the* great law which governs Animate Creation, in other words, what is the key to the actions which regulates man and animals? We answer, A LESSER EVIL MUST BE SUBMITTED TO, TO INSURE A DECIDED AND PERMANENT GOOD.

This law informs us that Pain, Suffering, and Privation, are so many elements of our nature; that we are born under this law; and that we must abide its dictates during the term of our earthly existence.

Our authority and proof for the existence of this law is, that God brought his own Son, the Saviour of the world, under the *letter* of it when He permitted man to crucify Him that we might be saved. The Deity considered it better that His only begotten Son should suffer the greatest abuse and suffering, and ultimately die than that the Family of Man should be destroyed.

We have exemplifications of this law in the Physical Universe, where life is sacrificed during the “rage of the elements.” It is better that a few lives should be lost than that such phenomena should not take place.

We trace the same influence in the intellectual and moral world.

To what self-denial must not an intellectual man submit, to prosecute literature and science? Too frequently do

men subdue a naturally vigorous constitution by their labours at the desk ; all this is borne to enable man to carry out particular investigations, and which require much of his time and patient consideration. If a man cannot tutor himself to such hardships, he will not attain to that success and position which his *will* so eagerly desires. SENECA has well said :—" Philosophy is not formed for artificial show or delight. It has a higher office than to free idleness of its langour, and wear away and amuse the long hours of a day ;" and certainly the study of philosophy and the acquisition of knowledge is no play work. In like manner, what difficulties and vexations does not a moral man too often experience in convincing his neighbour that the dictates of Conscience are the only proper rule of action, more especially when he sees an unprincipled man prosper in the inverse proportion that a man of principle experiences disappointments.

The same law holds the ascendancy in all the affairs of life. No man ever yet conferred a decided favour upon his species, but he encountered the displeasure and opposition of a portion of the community.

We perceive, then, that the Law, with which we set out, holds true with all Nature. What, then, is the relationship which holds between man and animals ?

ACTION is the order of nature. This is the grand end for which *all* animals were created. We know no instance of the existence of life, without an object and end to be derived from its inhabitant, consequently we say that, whatsoever has life, has also use, and we expect to derive something from it.

Now, how may we divide the uses for which animals

were intended? Animals are constituted to assist each other, in which they act as beneficially and affectionately as man does to his neighbour. They were introduced into the world and placed under the dominion and for the service of man. Animals are killed, and man eats them. This has never been objected to; it has never been suggested that so many thousand head of oxen and sheep might have their lives prolonged, if man would a little abstain from the use of animal food and accommodate himself to vegetable diet. That more animals are killed than there is any real necessity for, no one would be so absurd as dispute, yet this extraordinary fact and enormous sin is quietly passed over. It has been said that little real suffering attends the slaughtering of animals. But will it be denied that *much* real pain attends the preparatory process for the shambles? I, myself, have been horror-struck at the cruelties attendant upon bringing cattle to Smithfield market (London.) I have witnessed the agitation of the poor creatures through the unnecessary interference of dogs, and the bruises inflicted with long and heavy sticks by the drivers; but more, the depression and weakness induced by long fasts previous to being killed, besides other modes of pain. What sufferings can compare with these!

Animals are employed by the man of science, to aid him in his exertions for suffering humanity.

The lower animals then hold the same relation to man, that man does to science and humanity, and that they do to the Author of nature.

God instituted faculties to acquire knowledge to alleviate the suffering of fallen man;—He imbued the heart

of man with a desire to alleviate pain ; and he placed the lower animals under the power of man that he might best do with them for the benefit of his fellows, and consequently permitted him to employ them for the aid of science if he could make them available to that purpose.

If the lower animals were placed under the dominion of man, they, necessarily were given him for any purpose which he may be disposed to apply them to.

How then do we meet the objection of those who say that the Deity never willed that the lower animals should aid the efforts of science ? This objection involves a palpable absurdity. Such reasoners never once had thought of the existence and immense importance of the law we have laid down ; they had not taken that comprehensive view of the question which can alone decide it, but they had discussed the matter in a similar manner with a child who cries and feels himself injured, when his nurse unceremoniously removes him from a body, which, but for her timely interference would have burnt his fingers. The child looks at the object which is the dread of his nurse, but he never once thinks of the end or purpose which induced her to interfere. In like manner anti-experimentalists look at the pain and death of an animal, but do not consider the purpose for which such pain is inflicted, and the beneficial results which may be produced.

If, then, we have proved our position that “ a lesser evil must be submitted to in order to insure a decided and permanent good,” (which we maintain to be a law, not only imposed upon man, but one which equally regulates the universe of matter, and to have been handed down to us from God to his Son,) we shall have little difficulty in showing that the

Deity willed that the lower animals should aid the efforts of science.

We have already said that a strict and defined relationship exists between man and animals, and we must now enquire in what that consists.

As regards the mental and physical constitution of the inferior animals, it is only necessary to repeat what we have already proved, viz., that the most intimate analogy obtains between them and man, and that this analogy has been most availably applied in the prosecution of science. But this relationship and analogy only apply to man as man, and, therefore, to this world. What then may we venture to think is the relationship which the Deity established between Himself and the inferior animals? This question involves the important one—have the lower animals a *soul*, and have they to give an account of the actions done in the body, in the world which is to come? As the Scriptures have descended to us we nowhere find it expressed that they have a soul, therefore, we are entitled to infer that their mental as well as corporeal existence terminate in this world.

It would appear that the lower animals hold the same relation to the physical world and to man, that man does to the physical world and to God. The former have exercised the highest faculties of their mind, when they have discharged to their fellows those duties which come under the rule and law of the *moral* sense; when their sagacity procures to them food, and the other enjoyments of their nature, and when they render themselves the willing and faithful servants of man. Man, again, exercises the very same elementary intellectual and moral faculties, but these

have a far higher power, and greater range of action ; he (man) is the only true and lawful student of NATURE ; everything in the physical world—animate and inanimate, renders to him, through his guidance and power, a submissive and cheerful obedience.

Man, then, is lord of the terrestrial world. And we have no ground for believing that any direct relationship exists betwixt the Deity and the lower animals. Of course God is the Lord of all, but He placed man as His acting agent and ruler over everything into which He has infused the breath of life.

Man, then, regulates all the actions of the lower animals for his own especial service, and consequently, lawfully, and by command, appropriates their uses in aid of science, wheresoever he thinks that facts, by analogical reasoning, may be added to his stock of knowledge, and rendered available to suffering humanity.

It has been said that God never could have willed that the lower animals should be subject to pain and death ; and that He never intended that science should be aided at the expence of torturing those innocent creatures.

This is the whining complaint of anti-experimentalists. But I will venture to affirm that the experimentalist himself as deeply deplores this necessary but unavoidable evil, and that he feels as acutely for the animal he is operating upon as the man who has never witnessed an experiment and who can only paint suffering by the pencil of the imagination.

The late celebrated Dr. ARMSTRONG,* of London, fur-

*Lectures, p. 6.

nishes us with an admirable illustration when enforcing the necessity of post-mortem examinations. He says :—
 “Am I to add to the miseries which are already the lot of the parents of this child, which but yesterday prattled before them ? If I say he were to act thus, he would betray one of the most tender and hallowed trusts which one being can confide to another—he would be like the serpent insidiously stealing into the bosom of a family and inflicting a deadly poison there ; he would remain ignorant of the cause of death, and would be one of the most destructive individuals in that society whose confidence he possesses, and whose sacred trust he has sacrificed to a novel and a morbid sensibility. Let us make the bodies of the dead useful to those of the living.” It has been said, not less truly than beautifully—

“The angel of mercy stoppeth not to comfort, but passeth by on the other side, and hath no tear to shed when a cruel man is damned.”—*Tupper's Aphorisms*.

We will follow up the reasoning of that noble, benevolent, and independent man ! Shall we any longer permit ourselves to be guided by a false and dangerous philosophy—a philosophy born of ignorance, and nurtured by superstition ? Shall we refrain from making a legitimate use of those creatures which have been placed within our power ;—shall we be prevented from causing pain that good may follow ;—and shall we shrink from those necessary, albeit painful duties, the fulfilment of which may add that to our knowledge, which the wealth of India cannot buy,—and the imparting of which may restore to the cheerful hearth, those who are related to their friends by the fondest ties of love and affection, and whose blessings

and prayers will descend to us, and be the more precious because they are sincere !

To return. The whining complaint of anti-experimentalists to which we have just referred is founded upon a very narrow and superficial consideration. As regards the soundness and strength of the *moral* feeling of experimentalists, no one who peruses the history and professional character of experimentalists can, for one moment, entertain the slightest doubt. We have already sufficiently dwelt upon this topic. Paradoxical as it may be, we hold that the experimentalist is a man possessed of a more healthy moral feeling than the anti-experimentalist is, because the former looks to the *end* which may be obtained by inflicting pain, whereas the latter merely dwells upon the pain itself. Which condition of the moral feeling we hold to be strictly *morbid*. Such is the lamentable state to which our better feelings may be prone. To the *assertion* that the lower animals were never intended to aid science, it is sufficient to reply that, the pain attendant upon such aid, forms only a part of that general law under which all animate nature is placed. The different ranks of society form an admirable illustration of this law ;—we have the high, middle, and lower ranks of society ;—what is the philosophy of all this, but, that as we descend in this scale we find the suffering and privation to be greater, and as we ascend, we have the converse. Now, this law of society must ever prevail under a monarchical government, and we have only to look out of our street window at any period of the day to see it in actual operation. We see the menial in his various capacities, not only the humble servant, but too frequently the slave of

the exorbitant demands and pampered appetites of his more fortunate and wealthy fellow-man ; and we have only to *observe* to be assured that no small degree of mental and physical suffering feeds upon and consumes the frame-work of the less fortunate man. But, while every sensitive and properly constituted heart feels for such a one, he at the same time is obliged to acknowledge that the thing is just as it should be, because it could not be otherwise, if society is to exist at all, and if man and man are to live together with tolerable comfort and safety. From which we perceive that society, as it must be constituted, engenders many necessary but immediate evils. It is unnecessary to observe that if large bodies of men did not co-operate and form themselves into societies of various grades and of distinct powers and privileges, the family of man must exist in the most helpless and barbarous condition it could be possible to conceive. If, then, the Deity has imposed hardships, and suffering in proportion as we descend in the scale of society, (which, by the way, is another illustration of the law that a lesser evil must be submitted to, &c.,) it requires nothing more than the principles of common sense to suppose that Science can only be advanced at the expense of so much self-denial on the part of the investigator, and a certain amount of pain, and sometimes actual death in the subject operated upon. The corollary from which is that the All Wise Creator ordained that a particular quantum of suffering should attend the performance of beneficial results, and that the pain which attends the investigation of healthy and morbid structure forms only a small part of a universal and inflexible law.

We will now dwell for a little upon the claims of HALLER and JOHN HUNTER.

When we *think* of the above men, we associate with their memory and immortal spirits, the veneration of the Past, the Present, and the Future. We feel a pleasurable but impressive awe, and our common nature is ennobled in the reflection that the Inspiration of enthusiasm has been clothed in the garb of mortality, and that we have examples which may be to us as the EASTERN STAR to the pole of Scientific Truth and of Philosophical discussion.

The productions of their mind and the labours of their hand, which are before us, and which have come down to us through the common channel of human knowledge, forcibly recall to our recollection the solemn and *instructive* words of the philosophic poet—

“For who knows most, him loss of time most grieves.”

We are led to reflect upon the value of TIME and the certainty of ETERNITY, and we sigh and exclaim, Teach us to number and to put to the best use the *moments* as they fly, and impress us with the necessity of storing up and of making our knowledge available for suffering humanity.

We take hold of and look into the pages of HALLER and HUNTER, and if, unhappily, we want the imaginative faculty, we may yet judge of their intellectual treasure by their physical *capacity*; but the moment that we touch the silver strings of imagination, we are lost in astonishment and admiration. When the excitement from the sweetness of her notes has somewhat subsided, we col-

lect ourselves, and we calmly “inquire how such men as Haller and Hunter reasoned, or by what mode of investigation they were led to the discovery of the truths which immortalize their names.”

Haller and Hunter were Experimental Physiologists ; I am not aware of any other two men from the period of HIPPOCRATES to the present moment who operated so largely, and who so faithfully appealed to Animal Physiology as the only true *experimentum crucis*. We maintain that the quotations we have adduced, furnish sufficient proof of this position. We may be asked, could not their many discoveries which experiment has brought to light have been arrived at by reasoning upon the anatomical structure and their relations ? We unhesitatingly answer, No ! and we refer our reader to the facts which are most plentifully dispersed through our pages that he may examine the subject for himself. To this it may be said, discoveries have been arrived at without experiment.

This objection in no wise infringes upon our general argument ; it only goes to show what we would not be so absurd as refute, viz., that discoveries and improvements have been arrived at without experiment as well as through its aid. But this does not belong to the subject. We have never urged the doctrine that it is absolutely necessary for the study of every subject under physiology, therapeutics, or pathology, that we should have recourse to the living animal. All that we contend for is, that when the usual methods of investigating healthy and diseased parts have failed, the investigator should then be permitted to go to Nature herself for a reply, without being censured and held up as guilty of cruelty to animal life.

Now, as regards these additions to our knowledge which have been arrived at without recourse to experiment, it occurs to us that they hold a striking contrast with those which have been arrived at by experiment, not so much on account of the greater number which have been wrought out by the latter method, but the ease and success which have attended their results.

We have already said that the late distinguished Sir C. Bell, with one exception, operated upon animals which previously had been rendered insensible to pain, and, no doubt, this fact will have no small weight with those who differ from us. We have objected to this mode of eliciting nature's secrets, because this is not the genuine experimentum crucis, and because such investigations are open to the greatest confusion and uncertainty. We believe we are correct in stating that some errors were the result of this mode of experimenting, which have since been rectified by later physiologists. We would venture to affirm that the experiments of Majendie, Müller, and others of the French and German schools have, as a whole, been less open to objection because they were more successfully and satisfactorily conducted. We have only to ask how toxicology and therapeutics could be prosecuted on an animal rendered insensible? and surely we cannot but imagine that as great suffering is occasioned by the administration of medicines as the stimulus of the knife could produce. Indeed, we hold that the pain from the latter is infinitely less objectionable than the pain from the former, because time is implied. Let us suppose an animal for hours and days under the influence of a slow and perhaps fatal medicine, and let us imagine the suffering which would

attend its operation. Again in experiments performed by the surgeon such as those of the late Sir A. Cooper, and a few which recently were performed by Professor Syme,* of this city. The experiments which Mr. Syme instituted kept the animals in pain several weeks, before he could arrive at any results, when they were killed to ascertain the changes which had taken place. We need not inquire if it could be possible to make such experiments upon the insensible animal.

From which illustrations and many others that are passing in our mind, we perceive that while a few investigations may, and have been attended with the happiest results, many more do not admit of this *spurious* because partial way of conducting experimental physiology. We cannot but think much uncertainty would be removed by operating on an animal endowed with all the powers and *sensibility* of life.

The consideration, then, that discoveries and improvements have been arrived at without appealing to the sensitive animal, proves to be no argument at all. We admit that it may be an argument for *particulars*, but we object that so important a subject should be decided in so particular a manner. The question for our consideration is, Have we brought forward facts and illustrations to show that experimental physiology must be resorted to, or not? This is the question. To go to particulars and say that such an improvement was arrived at by observation and medical experience;—and that such another was successfully conducted upon an insensible animal, is not to consider

*See a paper in *Edinburgh Philosophical Transact.* "On the power of the periosteum to form bone." Read March 6, 1837.

our broad and general argument. If we can prove a position as a *whole*, we consequently do so for a *part*. But the converse will not hold. Logic will not bear out the assumption that a *part* involves the *whole*; but it allows that the whole involves a part. Particular instances are the same as monstrosities in nature,—they form exceptions to a law, and therefore are apart from the usual order of things, and must not be taken into account, but a uniformity of phenomena, or results, goes to constitute a law, and we *may* reason upon them.

We maintain, then, that it is the subject as one grand *whole* with which we have to do.

It is forgotten that it is out of our power to investigate the functions of life in the endless phases in which they are presented to our consideration by either mixed or abstract reasoning. We cannot reason upon function by the facts which have been arrived at from inanimate matter. The physiologist in *his* inquiries must go a step beyond the mathematician, logician, and physical philosopher: he may avail himself of their assistance, but he must not reason upon the axiom in physics, that a result once having taken place must again take place, otherwise the construction of the machinery must be entirely destroyed. In looking upon the *action* of a steam engine, we see nothing but steam as the result, and therefore perfect uniformity. In studying the actions of animal life, the operations of to-morrow, are not those of to-day, and a few minutes often place the functions of life in the most opposite and inexplicable conditions. The physiologist must *see* and *handle*. What phenomena he cannot study from the outward human form he must inquire for *within*.

The most important phenomena of life are precisely in the condition of the machinery of a watch within the case which contains it. If we wish to examine what bearing one part of the machinery has to the other, and the action which the several parts upon each other have as a whole, we must remove the case, and *see*. In like manner, as already so fully detailed, when Beaumont wished to know the different stages of digestion of his patient, the outer covering being already removed, he had only to look into the interior and *see*.

Now, one circumstance has always appeared to me to be exceedingly unfair in the arguments of anti-experimentalists. I have already said that the late Dr. Fletcher, to take him as an *instar omnium*, loudly protested against the experimentalist; yet, I confidently ask, who that has studied the work of that eminent man, must not acknowledge that he freely availed himself of the experiments of others, and that he worked upon their facts? From what I saw of Dr. F., I conscientiously believe that the circumstance was altogether overlooked by him. There was Fletcher making the most unlimited use of experimental facts, and yet condemning the authors of them! Surely this is a philosophical paradox of the human mind, or I don't know what to think.

To return to Haller and Hunter, I must express my surprise and regret that their method of studying physiology is so much overlooked and condemned. We are too apt to forget that such men ever existed, and consequently to act as though we were unmindful of the obligations under which they have placed us.

Now, TRUTH obliges me to say that we must not ex-

tend this censure to our German and French brethren ; I hope I shall not be blamed for confessing a truth which we are too apt to lose sight of, viz., that we are more indebted to them for improvements in physiological science than they are to us. If we want the latest and best work on physiology, we must take up a foreign book for it. And how has this come about ? It should not be so. The only reason I can give is, that they have more religiously followed up the *experimentum crucis* of Haller and Hunter.

I need not enlarge on this topic ; I have exhausted my text.

But, we must “sum up,” as the lawyers do their “evidence,” otherwise the chapter will not have a finished appearance.

Certainly we should arrive at something definite ; the argument much requires it. When this subject is broached in general conversation, the substance of what is said amounts to this, viz. :—“ We have no objection that pain should be inflicted, provided it be absolutely necessary, but we cannot see the necessity for it.”

And, again, when experiments are performed they are termed “cruel,” the persons who so unceremoniously jump to this conclusion, never having properly enquired into the nature of those so called cruel experiments, and, for the most part, being individuals who are quite incapacitated for the task.

I had the good fortune to be taught Anatomy by Dr. KNOX, and in conversation with him lately on the subject of these pages, he expressed himself opposed to actual experiment until all other means of

prosecuting scientific investigations had been tried, and had been found insufficient. And this distinguished physiologist, in his lectures, is in the habit of saying that our continental brethren are building human anatomy upon comparative anatomy. With the most perfect deference and respect for any opinion coming from such high and acknowledged authority, I cannot but disagree *in toto* with this view of the matter, because the doctor would appear to place little importance upon *analogy*. Now, I venture to maintain, (as already insisted upon and supported by facts) that human physiology is much indebted to analogical reasoning upon the facts of comparative anatomy. To argue that, human and comparative anatomy and physiology are totally distinct and cannot aid each other, is to say that the mental and physical organization of the one holds no relation to the other, a doctrine I have already disproved, and will not allow to pass for one moment. If the lower animals think and act in a proportionate degree with ourselves, we must admit the analogy which subsists between us and them, and consequently are bound to deduce that, if certain operations are constantly going on in the inferior animals, similar changes must take place in our own bodies.

We maintain, then, that the facts and arguments we have brought forward, justify the conclusion that SCIENCE is entitled to, and has a legitimate claim upon any assistance which her cultivators may think it possible to derive from experimenting upon the inferior animals ;—that the amount of pain inflicted, which all rightly-constituted minds cannot but deplore, receives

mitigation and exemption from censure in the fact that *suffering* was instituted for wise and benevolent purposes, and that it forms a part of a grand and universal law in the design of the universe.

CONCLUSION.

CANDID READER ! It is *you* whom I have addressed throughout this essay.

I venture to think that the facts which I have transcribed have induced you to consider the subject for yourself, and have enabled you to become my critic.

I wish you to understand that I consider my endeavours of a kind in which the public should as much interest itself as the members of the medical profession. For that reason I have adopted a very different mode of arrangement from what I would have done had I exclusively wished to address the professional reader.

I would have you consider the subject to be of NATIONAL importance. Your reflections will have led you to think that I also wish to revive the mode of studying physiology practised by HALLER and HUNTER, and which was rewarded by many and brilliant discoveries.

My desire has been to set the PUBLIC MIND *right*

with regard to the necessity and morality of experimental investigations, and that *it* would not any longer calumniate and revile those to whom it owes the imperishable gift of gratitude for their endeavours to investigate disease, and prolong LIFE.

You will have remarked that TRUTH and JUSTICE have imposed upon me the painful necessity of criticising the opinions of men whose names and works will carry them down to the latest posterity, and whose labours have ennobled their species.

I beg you will do me the justice to think that whatever disrespect and acrimony may *appear* in my remarks on their opinions, such only exist in the words which the peculiarities of our language have obliged me to employ, but from which my *will* and my feelings would shrink as from a cup of poison. I am anxious to mention this because I should be grieved that I had condemned myself by having caused my intentions to be misinterpreted.

And now that my mind is at ease on such matters, permit me to address you further in a few words.

I have said that my topic is of National Importance, because it strikes at the root of national prosperity and existence. The prolongation of life constitutes the prosperity of a Nation.

The ravages of disease have, in a short time, reduced a population of several thousands to as many hundreds.

Surely, then, it behoves the guardians of a nation to cherish and support those who spend their lives in averting disease and promoting health with all the care and indulgence of a father's pride.

We are humbly of opinion that the cultivators of ex-

perimental physiology have a claim upon public support and sympathy. This is the *true* principle. The labourer is worthy of his reward. But I will leave this depressing scene and hasten to a more cheering prospect.

The Rev. Dr. Chalmers has published an eloquent and argumentative Sermon "On the respect due to Antiquity." We shall borrow the idea embodied in this text, and apply it to our profession—On the respect due to the Antiquity of Medicine.

The Antiquity of Medicine leads us to reflect upon the veneration which attaches to the professors of it, and which will be handed from generation to generation until SCIENCE is no more.

We dwell upon and *attempt* to fathom the enthusiastic spirit which actuated the illustrious Fathers of Medicine, and we sum up our survey by saying that it was boundless—that it was fathomless—in other words, that the *soul* of Science supported their physical corruptibility.

We then leave the past and compare it with the present, and we have a striking contrast indeed. But we must observe, that the present history of our profession properly took its origin at the commencement of the seventeenth century. We should therefore inquire the condition of Medicine up to this period, and then draw the contrast.

As we have already said, the anatomy and physiology, and the practice of medicine, were built upon comparative anatomy, and considering the difficulties with which they had to contend, we are lost in astonishment at the advances which they actually made. *We* have now the powerful aid of analogy to work upon.

The seventeenth century opened the dawn of a new era in the philosophy of medicine. Bigotry and superstition had given way before the light of reason, and human bodies were examined.

EXPERIMENTAL SCIENCE now properly commenced, and they conjoined the science of physics, which is purely experimental, with the experimental science of animal life.

Our pages will enable the reader to know what the present owes to antiquity ; what is due to the present itself ; and what the future may expect from the present.

The operations of the human mind are *almost* past finding out. It has lately been attempted to show that the experimental study of animal life should be dis severed from its legitimate companion, the experiment of physics, as unnecessary, cruel, and, therefore, eminently irreligious. It is for you, candid reader, to decide how far we have proved the opposite position.

The past is the base, the present the superstructure which is being built, and the future must raise up the Egyptian pyramid of medical science until it reach the heavens in adoration of its Creator.

The respect, then, which is due to antiquity, calls upon us from the monumental tombs which their inspiration and labour have presented to us, to cherish up and nurture with the fondest tenderness, the SPIRIT which moved *them*.

Their monumental tombs are their WORKS. Such is the language and LIFE of a book. Their books are before us. Let us breathe and be filled with the spirit which inspired their pages.

Books on science are so many constellations, and the enthusiasm of the philosophical spirit is their guide, their polar star.

The formation of the scientific character necessarily embodies the following elements :—Thought, imagination, speculation.

I would observe with respect to thought, that if we but for a short time examine the trains of it as they rise up within our mind, we note uncertainty and irregularity : our mind will not always call up a subject at will, but that same topic will come up when we were not expecting it, and if we do not seize upon it at the instant, it is too often gone for ever.

Our thoughts do not arise in methodical order ; after making them our own, we may then arrange them ; often it is exceedingly difficult, sometimes it is not desirable.

Let our motto be *possunt quia posse videntur*. If we go in search of knowledge in the *proper* spirit, we can command any branch of it. Humility and industry will, in time acquaint us with the elementary sciences, that we may call them our own.

Let not *worldliness* cause us to forget what we owe to our predecessors, and the homage which is due to the Spirit of Science.

Attention to these heads will always cause us to *feel* the respect which is due to the Antiquity of Medicine.

The contemplative *Bonnet* offers for our consideration the outpourings of his heart. We would do well to think likewise.

“ Je m’élève à la RAISON ETERNELLE, j’étudie ses Loix & je l’adore. Je contemple l’Univers d’un œil

philosophique. Je cherche les Rapports qui font de cette Chaîne immense un seul Tout : je m'arrête à en considérer quelque Chaînons, et frappé des traits de Puissance, de Sagesse et de Grandeur que j'y découvre, je essaie de les crayonner sans les affoiblir."

Let us grasp at *universality*, or, to use the very apt word of Goethe, *many-sidedness*. And we sum up with quoting a passage from a very recent eloquent writer :—
 "WHATSOEVER A MAN KNOWS TO BE HIS DUTY AND YET REFRAINS FROM DOING, BE THE THING EVER SO LITTLE OR THE TEMPTATION EVER SO GREAT, IS A DEADLY SIN, AND THAT INDEPENDENTLY OF ALL WRITTEN LAWS WHATEVER ; DEADLY, FOR EITHER DUTY HAS NO MEANING AT ALL, OR ITS SIGNIFICANCE IS IMMENSE AND ETERNAL."*

CANDID READER ! pardon the irrelevancy of these unconnected reflections ; weigh well the argument presented to you, but forgive the poor endeavours to sustain it ; make known your objections, and correct my errors.
 —FAREWELL.

*Lay Sermons on the Theory of Christianity. Smith, Elder and Co., Cornhill, London, 1841.

Miserably written
 THE END.



APPENDIX A.

SIR Charles Bell has honoured me by transmitting the following communication with a request that it might be inserted in this work.

“Sir Charles Bell has expressed himself against experiments, and in favour of the careful study of function and minute dissection. He conceives that we are not licensed to make experiments which amount to the protracted dissection of living animals, especially where the question regards the sensibilities of parts. First, because by such protracted suffering the sensibilities are disturbed, that pain is only one form of sensibility. There are many instances, he adds, where the course of impression along the nerves is inwards, or towards the sensorium, yet differs from the pain as of the skin. There are many of the finer sensibilities which influence and combine extensive classes of muscles, and yet have no resemblance to that sense of suffering which providence has given as a protection to the frame.”

The following reflections occurred to me while Sir Charles was so good as explain the above objections, and although I have since then given the opinions stated in the body of this work my fullest consideration, I find I have nothing to alter.

I feel very uncomfortable in being obliged to differ from one to whom I look up, and from whom I have learnt much.

It is painful for a pupil to be opposed in opinion to his professor; it cannot, however, sometimes be avoided. It is merely an instance of individual minds arriving at different conclusions by pursuing separate modes of investigation.

In the first place, then, I have endeavoured to show, that the “study of function” is nothing more or less than the study of phenomena, and that phenomena can only be studied by seeing them in action. I have

said that a veil is thrown over the functions or actions of many of the most important operations of the animal economy, which veil is the skin and muscles, and must be placed aside in order to see the machinery at work which they most effectually hide. And I have given the apt illustration of the "outer-man," being to his vital and essential inner organs what the various parts of a watch are to the case containing them. I may be told that this illustration is too mechanical, but I feel satisfied that a little attention will find the argument to be strictly parallel. I have objected to and shown the inability to study function by the mere eye of observation, and have adduced cases in proof of this position.

The physician practises solely by observation. It is through this faculty that he studies symptoms. But we must step back a pace to enable us to move forward. The study of anatomy and physiology precedes his duties as physician. By the first he learns what the human body is in its inanimate condition, and he performs precisely the same part that the student of natural philosophy does in examining any complicated apparatus. By the second he is enabled to see the operations of *Life*, although we do not know what constitutes life.

We perceive, then, that it is during the studentship of physiology that the man who afterwards becomes physician, studies function. It has been one main object of my pages to show that function can only necessarily be studied on the living animal. I have not said that our lecture-rooms should become so many theatres for experimental study, because what has already been ascertained through experiment is published in detail and in perspicuous language that we may know and see through the mind's eye the nature of particular functions, but I have contended that the functions of such organs about which any doubt still hangs, should, at once, be submitted to an *experimentum crucis*—to experimental physiology.

If, then, what we have already advanced has not proved the impossibility of studying function by the "minute dissection" of the dead body in man and animals, and by the observation of symptoms, it is idle to attempt it now.

Secondly. I humbly conceive that Sir Charles Bell is unhappy in having involved our proper subject—experimental physiology—in metaphysical language.

To speak of the "sensibilities of parts" and "that pain is only one form of sensibility," places the subject in a labyrinth, and how are we to get out of it? because, it obliges us to consider that fickle and not always tangible thing, moral sensibility.

Now, we talk of the sensibilities of the soul, of conscience, of the heart,

all which properly come under the head of moral sensibility; and again of intellectual and physical sensibility. I conceive, if the several forms of sensibility be laid aside, and the word sensibility be used as synonymous with pain in its various degrees, the matter will become very simple.

As set forth in the text, the degree of pain varies with the part affected. To commence with animals lowest in the scale,—we find that several classes of them outwardly manifest no trace of it, whatever be the injury inflicted. By this I do not mean to affirm that sensibility is not possessed by them, only that it must exist in a comparatively small ratio. My impression is, that all animals have sensibility, because I believe all animals to be furnished with mind adapted to the sphere within which they move, and therefore a sensibility which approaches, if it does not actually consist in moral sensibility, that is to say, they know and feel when any injury has been inflicted. All this is apart from physical sensibility. As we ascend in the scale, we find that animals show signs of physical injury, and in those several species which so closely approximate to man, we know that the intellectual, moral, and physical sensibilities are merely so many degrees in remove from ourselves.

“Protracted dissection” and immediate dissection, as opposed to it, are matters in which time is involved; we are not sure but that the shock to the nervous system is greater, and therefore that the “re-action” is more dangerous to the person operated upon than if a much longer time had been taken. I was very curious on this point during my hospital attendance, and made it a particular subject of observation. I noted that those operations which were the most dexterously performed, i. e., which were done in the least space of time, were often those which were least successful. From what I have seen I am of opinion that an operation or dissection slowly performed stands better chance of recovery. It has always appeared to me that the conclusion has rather been “jumped at” than philosophically arrived at, viz., that a slow operation inflicts more suffering and lesser probabilities of success than when “dexterously” performed. I imagine that the “sensibilities of parts,” or of the several tunics, have time somewhat to recover themselves when slowly and carefully cut through. Consequently the “protracted dissection of living animals” is not so objectionable as what has been represented. Again, I hold that the “sensibilities are disturbed” as much so during any surgical operation, as they can be by dissecting a living animal. Indeed, a greater analogy obtains between a surgical operation and a dissection on a living animal than many will be disposed to allow. In the latter instance, the object is as praiseworthy and legitimate as it is in the former. The ex-

perimental physiologist has for his object to ascertain the manner in which disease may be cured by studying healthy and morbid function; the surgeon for his, to endeavour to cure disease. In one word, these combined, offer another instance of cause and effect. One precoding the other, but necessarily elements to form a whole. But it may be said that the operating surgeon does not look for function, his object is solely to remove disease. True; but I have adduced facts to show that however much the "sensibilities are disturbed" in the living animal, that precisely the same results have come about which had been arrived at by reasoning on the facts of anatomy. Now, this explanation places the just named objection on a very shallow foundation. I conceive that an experimentalist, by repetition of his experiments, soon acquires so much command of the faculty of observation, as to enable him correctly to distinguish and trace out phenomena, and not to confound one action with another. In short, we can imagine the experimentalist to be met by the same difficulties that the use of the microscope involves, where, in the hand of the tyro, all is perplexity and confusion. "Time maketh perfect." To Sir Charles Bell the world stands indebted for having demonstrated what formerly could only be conjectural, viz., that man is possessed of nerves, having different objects for their end. One class of which "Providence has given as a protection of the frame."

As already so fully insisted upon, we have every reason to believe that we are entitled to inflict pain of the least amount, if good can result from it.

These, then, are all the observations I have to make on the objections started by my revered preceptor; and I trust, that what I have penned, under a sole sense of justice and truth, will not be construed into presumption and impertinence.

APPENDIX B.

(1.) ALTHOUGH, when viewed in the aggregate of his faculties, moral as well as physical, man confessedly holds the first rank among animals; yet, exclude from our consideration those intellectual powers and moral qualities by which he is essentially characterized, and confine our view to his merely animal nature, we find that he scarcely differs in any important point from any species of the higher classes. In each there is the same necessity for air, and sleep, and food; and the nature of the food and the mode of its digestion, is converted into blood of the same character, and distributed in the same manner through the system; the constituent parts of the body and their mode of growth are almost precisely the same; for the bone, muscles, tendon, spine, hair, and brain of the horse, or deer, or tiger, or bear, scarcely differ in their physical or chemical characters from the corresponding parts in man: similar secretions, as the bile, tears and saliva, are separated by similarly constructed organs; and similar parts become similarly diseased; the special senses of sight, hearing, taste and smell, are exercised through the medium of similar organs, simply modified according to the particular wants of individual species; the sources of mere bodily pain or pleasure, are generally the same; the instinctive affections, passions and properties, are the same, and are manifested in the same way; the angry look of a dog, for instance, bespeaking the internal feelings as strongly as that of the man, and the playful and rapid movements of the young puppy resembling the careless hilarity of childhood, no less than the stayed motions and wary eye of the aged hound resemble the sedateness of the aged human being."

(2.) "Thus it appears, that, in general structure and organization, the brute creation is nearly allied to the human species."—*Smellie's Philos. of Nat. Hist.*

"Upon the whole, the dignity of man's rank depends not upon the structure of the organs. It is from the powers of his intellect alone that he is entitled to claim a superiority over the brute creation."—*Ibid.*

(3.) "The understanding is, by reason of its own nature, carried on to abstraction, and fancies those things to be constant which are wavering; but it is better to dissect nature than to abstract her." "That is, by maturing experiment, rather than by contemplation, and reasoning upon notions, without the proper facts." "Here we would place a true model of the world in the human understanding, such as the world is found to be, and not such as any one's reason might make it. And this cannot be done without first very successfully dissecting and anatomizing the world." Bacon, *Novum Organum*; Shaw's Transl.

(4.) *Mémoire sur le Méchanisme de l'Absorption Chez les animaux a Sang Rouge et Chaud*; lu à l'Académie des Sciences de Paris, en Octobre, 1820.

Mémoire sur les Organes de l'Absorption Chez les Mammifères; lu à l'Institut, le 7 Août, 1809;

Sur la nareotine, ou matière de Dérosne; *note*—sur l'introduction des liquides visqueux dans les organes de la circulation, et sur la formation du foie gras des oiseaux;

Experience sur la rage; *Mémoire sur les vaisseaux lymphatiques des oiseaux*;

Mémoire sur la structure du poulmon de l'homme; sur les modifications qu'éprouve cette structure dans les divers âges, et sur la première origine de la phthisie pulmonaire;

Considérations générales sur la circulation du Sang;

Mémoire sur l'action des artères dans la circulation; lu à l'Académie des Sciences en 1817;

De l'influence des mouvemens de la poitrine, et des efforts, sur la circulation du Sang;

Sur l'entrée accidentelle de l'air dans les veines, sur la mort subite que en est l'effet; sur les moyens de prévenir cet accident et d'y remédier.

Formulaire pour la préparation et l'emploi de plusieurs nouveaux médicamens, tels que la noix vomique, la morphine, l'acide prussique, la strychnine, la vératriue, les alcalis des quinquinas, l'iode, etc.;

Sur les organes qui tendent ou relâchent la membrane du tympan et la chaîne des osselets de l'ouïe dans l'homme et les animaux mammifères;

Anatomie d'un chien eyelope et astome;

Fievre intermittente pernicieuse, guérie par une faible dose de sulfate de quinine; Tome i., 1821;

Histoire d' une maladie, singulière du système nerveux.

Note.—Sur l'anatomie de la lamproie; lu à l'Académie des Sciences, par M. M. Magendie et Desmoulins;

Expériences sur les fonctions des racines des nerfs rachidiens;

Expériences sur les fonctions des racines des nerfs qui naissent de la moelle épinière. Tome ii., 1822;

Sur le Siége du mouvement et du sentiment dans la moelle épinière;

Sur les fonctions des corps striés et des tubercules quadrijumeaux;

Histoire d' un Hydrophobe, traité à l' Hôtel-Dieu de Paris, du moyen de l'injection de l' eau dans les veines; Tome iii., 1823;

Le nerf olfactif est il l'organe de l'odorat? expériences sur cette question.

De l'influence de la cinquième paire de nerfs sur la nutrition et les fonctions de l'oeil.

Suite des expériences sur les fonctions de la cinquième paire de nerfs, lu à l'Académie des Sciences, le 3 Novembre, 1824.

Memoire sur les fonctions de quelques parties du système nerveux, lu à l'Académie des Sciences le 7 Mars, 1825; Tome iv., 1824.

Note sur deux nouvelles Espèces de Gravelle;

Second Mémoire sur le liquide qui se trouve dans le crane et l'épine de l'homme, et des animaux vertébrés; lu à l'Académie des Sciences, le 4 Décembre, 1826.

Troisième et dernière partie du Second Mémoire sur le liquide, &c., &c., lu à l'Académie des Sciences, le 12 Février, 1827.

Ligature de l'artère carotide primitive; Tome vii.

Rapport fait à l'Académie des Sciences sur un mémoire de M. Leroy D'Etiolles relatif à l'insufflation du poumon considérée comme moyen de Secours à donner aux personnes noyées ou asphyxiées; Tome ix.

Magendie's Writings. Journal de Physiologie.

(5.) " There are two sources from which a knowledge of the functions of any part may be discovered, viz., by making experiments on living animals, or by noting the symptoms associated with a morbid state of the part. See Anatomy of the brain, by Alex. Monro, M.D., Prof. Anat. Univ. Edin. Dr. Monro continues:—" About two years ago, I saw, in the garden of Sir William Hamilton, several young rabbits and chickens, to all appearance in the most perfect health, through whose brains and cerebella, wires, small skenes of thread, &c., had at different times been passed, in various directions; and Sir William assured me (what was indeed the condition of his experiments) the animals do not seem to suffer pain at the time the needles, &c., are passed, with exception of the

slight smart in puncturing the integuments. The brain has been long known to be wholly insensible. His experiments, he tells me, prove, that if the great blood vessels are avoided, and a perforating instrument of too great diameter be not employed, the brain (basilar no less than coronal region), nay, what is still more remarkable, the cerebellum may, without pain, or inflammation, or ramollisement, and, with exception of a very limited focus, without apparent injury to the vital functions, be almost literally made a pin-cushion. Though not a medical man, Sir William thinks that if the cerebral non-irritability of the smaller animals holds good in man, which we have little reason to doubt, and if the larger calibre of his blood-vessels do not impose an impediment, a permanent and gradual drain, in cases of hydrocephalus, may, without any danger, be obtained by passing a cannula, of a particular construction, and with lateral perforations, through the ventricles. By this means, in *acute* hydrocephalus, the sudden pressure of the water, which is probably in most cases the proximate cause of death, would be taken off, and time allowed for the morbid diathesis or the obstruction to abate; in *chronic* cases the further accumulation of fluid would be prevented, and, by the gradual evacuation of that already collected, which could easily be regulated, combined, perhaps, with gentle pressure, the brain and cranium might be rapidly restored to their natural relations. To pass a wire, corresponding to such a cannula from side to side, through the middle or lower part of the ventricles, he found to be an operation absolutely of *no danger whatever* in the smaller animals—as yet, he has tried it in none larger than the cat. In the substance of the brain the foreign body is in a few days surrounded by a toughish sheath of coagulated lymph; adhesion of this to a wire or cannula is prevented by occasionally turning them. In a great many experiments (without a single accident) Sir William never found that such a perforation produced any apparent effect; and several animals (quadrupeds and birds) continued to exhibit for years the highest health and vigour, with all their instincts, whose heads were transfixed, by sundry substances, in this and other directions.—Ibid, pp 15, xvi. xvii. (foot note.)

“PREFACE.”

(6.) Lorsque je me livrais à l'étude de la physiologie, j'étais frappé des nombreuses lacunes que cette science présentait, et des explications gratuites qui ne me paraissaient reposer sur aucun fait; et je me proposais

de chercher moi-même la vérité sur ces différens points. Telle a été l'origine des expériences que j'entrepris, aussitôt que je fus débarrassé de mes examens.

Le système nerveux ganglionaire fut, de tous les sujets vagues et obscurs, celui qui fixa la plus mon attention.

Les fonctions mal déterminées, on même plutôt supposées que démontrées, ne concentrèrent sur lui une fois que je l'eus abordé. L'importance du sujet qui s'agrandissait à chaque instant, et les heureuses applications qui s'en faisaient naturellement à la physiologie et à la pathologie me firent appesantir sur son compte beaucoup plus que je ne le pensais d'abord : une expérience en amenait une autre : une obstacle que je surmontais d'une côté, soulevait d'une autre une difficulté qu'il fallait résoudre.

Le plaisir que j'éprouvais chaque fois que ma curiosité était satisfaite, soutenait et excitait mon zèle. Mes expériences se multiplièrent ainsi à l'infini ; et j'obtins des résultats qui ne fournirent l'explication d'un grand nombre d'actes physiologiques qu'on n'avait point encore expliqués.

Comme je n'avait travaillé que pour mon instruction personnelle, je jouissais paisiblement de mon travail, sans songer que je dasse jamais legaire connaître, lorsque la Société Médicale d'emulation mit au concours pour le mois d'août 1822, une question sur l'anatomie, la physiologie, et la pathologie du système nerveux ganglionaire.

Le programme me tomba entre les mains, un mois avant le terme fixé. Je résolue de me mettre sur les rangs ; mais il me fut impossible de faire usage de mes expériences ; je n'aurais pas même eu le temps de les mettre en ordre.

Je rédigerai à la hâte les résultats que j'avais obtenus, et je les envoyai.

Mon mémoire ne fut reçu que un jours après la clôture du concours, ce donc je fus informé par M. le docteur Villermé, alors secrétaire général de la société, qui avait reconnu mon écriture. Mon travail fut connu de quelques personnes qui m'engagèrent à le refaire, en appuyant chaque opinion des expériences qui l'avaient fait naître, et à le publier promptement ; ou, si cette réforme devait être trop longue, à publier la partie, physiologique, tout imparfaite qu'elle 'était, a fin de prendre date.

L'événement a prouvé combien leur conseil avait été sage. Le 1^{er} Janvier 1823, je mis donc au jour mon *Memoire sur les fonctions du système nerveux ganglionaire*. La maniere dont il fut reçu, et la langage peu mesurée dont certains critiques se servirent, ne firent faire une revue sincère de mes opinions et de leurs motifs. Heureusement je pouvais les appuyer chacune sur des faits nombreux et détaillés, et il en résulta une conviction et une sûreté nouvelle et plus positive pour moi. Seulement

je sentir de plus en plus la nécessité de reprendre mon travail par ses bases. La fondation du prix de physiologie expérimentale par feu le Baron de Montyon, stimula mon zèle et au commencement de 1826, j'en voyai à l'institut ce que j'avais pu refaire sur une base large et vraiment expérimentale. Cette partie comprenait les deux tiers de l'ouvrage. Le succès flatteur que j'obtins, me confirma dans l'idée que j'étais dans la bonne route; et j'achevai sur le même plan. Si je ne l'ai pas livré plus tôt à l'impression, c'est que j'aurais désiré refaire quelques expériences, et en ajouter même de nouvelles sur plusieurs points. Mes occupations s'y sont toujours opposées; et comme je vois l'impossibilité de m'y remettre, je me décide à ne pas différer davantage. J'ai cru devoir rappeler ces circonstances, afin de faire connaître les époques auxquelles remontent les idées consignées dans cet ouvrage, et de prévenir toute espèce d'inculpation, ou de récrimination, en mettant le lecteur à même de juger à qui appartient la priorité. Il est d'ailleurs si naturel de voir les mêmes idées se présentent aux personnes qui s'occupent du même sujet. Depuis quelques années, le système nerveux a été le sujet des plus laborieuses et des plus utiles recherches des savans. C'est aux brillans résultats auxquels sont arrivées les Magendie, les Tiedemann, les Fleurens, les Serres, les Rolando les Meckel, etc., que la science est redevable des progrès immenses qu'elle a faits. Ces physiologistes célèbres ont concentrés leurs recherches sur le système nerveux cérébro-spinal, ce qui doit faire regretter qu'ils ne se soient pas également occupés du système nerveux ganglionnaire, parcequ'ils y auraient apportés cet esprit méthodique d'investigation qui prépare et qui assure le succès. Ils ne l'ont point fait. Puisse-je en publiant mes recherches, sinon remplir entièrement cette immense lacune, du moins signaler ce qui reste à faire. Cependant la facilité avec laquelle les faits pathologiques trouvent une explication naturelle puisée dans mes opinions physiologiques, me fait espérer que mon travail ne sera peut-être pas trouvé sans intérêt. Aussi ai-je cherché à faire l'application sévère de la physiologie à la pathologie, autant qu'il m'a été possible sans m'écarter de mon sujet; de même que je suis appuyé bien des fois sur des faits pathologiques, pour confirmer l'exactitude du résultat de mes expériences.

De façon que mon travail est en quelque sorte un ouvrage de physiologie fait avec de la physiologie. J'aurais voulu, s'il eût été possible, traiter ces deux sciences en entier, au sujet du grand sympathique, parce qu'elles se prêtent un secours mutuel, et que je regarde comme impossible de les séparer, quoi qu'en aient dit quelques détracteurs de la physiologie, et surtout de son application à la pathologie, entre autres le docteur Prus,

qui s'est le plus déchaîné contre cette alliance, en s'étayant des raisonnemens les plus specieux et des sophismes les plus séduisans. Il n'importe pas en effet, de savoir, par exemple, *comment un même nerf transmet au cerveau des impressions aussi différentes que le sont celles du chaud, du froid, du sec, de l'humide, de la douleur, du plaisir, du chatouillement, du fourmillement*, de la cuisson, de la figure, etc.; mais de savoir qu'il les transmet; que c'est bien lui qui est l'organe, le seul organe de cette transmission. Tout son échafaudage de raisonnemens ne paraît être bientôt qu'un badinage, lorsque immédiatement après, on voit l'auteur fonder toute sa théorie sur des idées physiologiques, qui sont au moins tout aussi sujettes à la controverse que celles qu'il a combattues. Au reste, je n'ai jamais dit que ce que j'ai vu, et quoique je sois bien loin d'avoir tout dit et tout vu, toutes mes conséquences n'en sont pas moins si sévèrement détraites de l'expérience et de l'observation, qu'il me semble impossible d'en déduire d'autres, et que les opinions théoriques auxquelles j'ai été conduit, me paraissent les plus naturelles. Je les crois l'expression simple et franche de la vérité, qui a toujours été le but de toutes mes recherches.

En étudiant les fonctions du système nerveux ganglionnaire, ou plutôt la parte qu'il a dans chaque fonction, je ne me suis attaché qu'à la fonction elle-même. J'ai négligé une foule des questions très-importantes d'ailleurs. Ainsi je n'ai pas cru devoir parler des conduits que Leuwenhoek, Housset, etc.; avaient trouvés dans les filets nerveux, et que le docteur Bogros y a retrouvés tout seul en 1825. Je n'ai pas cru devoir m'occuper non plus de l'embryogénie et de la névrologénie, partie de la science, qui est si redevable à M. M. Serres, Geoffroy St. Hilaire; je me suis strictement renfermé dans les bornes de mon sujet, afin de mieux l'approfondir. Cependant je ne me dissimule pas les nombreuses lacunes qu'il présente encore; mais à qui la nature a-t-elle jamais dévoilée tous ses mystères à la fois? *Illa arcana (naturæ) non promiscuè patent; reducta et in interiore sacrario clausa sunt.**
 Recherches Expérimentales sur les Fonctions du système Nerveux Ganglionnaire.

BRACHET.

"Even from the inferior animals some lessons might be derived; hence the ancients, who loved to record facts through the medium of allegorical fable, pretended that Melampus discovered the peculiar properties of hellebore, from its effects on his goats; and that Polydus, observing a

* Seneca natur, lib. 7, cap. 3.

serpent apply a certain herb to another of its kind, that was wounded, introduced it into practice, p. p. 2 and 3.

"Galen has contended for the acquaintance of the Asclepiades with anatomy. He tells us, that from early childhood, their sons were instructed regarding the knowledge of the human frame; in fact, that they were taught their anatomy and their alphabet together; but if the ancient commentators on the writings of Plato be correct, such an assumption is visionary, and unfounded. With the more prominent elementary parts, such as the position and connection of the bones with each other, it is but reasonable to suppose that they could not be altogether ignorant, as the reducing of fractures and dislocations must have early assisted them in such investigations; but from human dissection being prohibited as a study, it could not otherwise be than that their notions of the minute structure of the body were rude, theoretical, and erring; being wholly educated either from comparative anatomy, or the instruction of the Egyptians, among whom the practice of embalming afforded ampler scope for observation. In fact, to confute the assertion of Galen, that anatomy had acquired anything like perfection among the Asclepiades, it is only necessary to say, that, at the time of Hippocrates, it was full of errors, as will be briefly shown when we enter upon its examination. The Asclepiades being the priests who administered in the temples dedicated to Esculapius possessed only opportunities of acquiring anatomical knowledge from the dissection of the lower animals, presented as offerings or sacrifices; a cunning law of the temple commanded every portion of these to be consumed within the sacred walls.

The touch of a dead body being a profanation alike with Jew and Greek, it is not easy to see how anatomy could be administered among the ancients." P. p. 25-6.

"Alcmoeon deserves particular celebration from his being the reported father of comparative anatomy. Religious prejudices so completely standing in the way of human dissection, he is said to have applied himself assiduously to the study of the organization of such of the lower animals as might be supposed more nearly to resemble man in their structure." P. 30.

"But his more accurate perception of the fitness of things taught him, that the practice of the healing art must be based, not on speculations, but on the results of observation and experience, guided by philosophical theory." Page 44.

"It is said to have been a maxim with him (Hippocrates) that, when medicine failed, recourse should be had to the knife, and when the knife

was unsuccessful, to fire." Page 57.—*Moirs's Ancient History of Medicine.*

(8) "In order to assist in developing the intricate process of generation, Harvey was supplied, by Charles I., with deer, which were opened and examined at different intervals after conception. Comparative anatomy, although we regret the cruelty that it has occasioned, has contributed to resolve many intricate questions of the human physiology."

"Dr. Hales, an English clergyman, made many experiments on horses, dogs, deer, and other brute animals, which are published in his '*Vegetable Staticks.*'"

"It is, however, from the epoch of A. Vesalius, (1539) a physician of Brussels, in Flanders, and contemporary with Charles V., that we must date the origin of modern discoveries in this science (anatomy) either in England, France, or Germany, before the beginning of the 17th century."—*Extracts from Dr. Black's Historical Sketch of Medicine and Surgery.*

(9.) We have *parks and enclosures* for all sorts of *beasts and birds*; which we keep not only for curiosity and entertainment, but for dissections and experiments, with a view to discover what may be wrought upon the human body; and by *these* means we become masters of many strange effects; such as the continuing alive, though several parts, which you account vital, be perished and cut away; the recovering of some creatures after they seem dead, and the like. We also try poisons and other medicines upon them; as well with regard to *Chirurgery* as *Physick*. By art, likewise, we make animals larger and taller than their kind; and contrariwise, stint their growth. We also make them more fruitful than their kind; and again, barren, or not generative. We likewise make them differ several ways; in colour, shape, and activity. We have methods of making commixtures and copulations of different sorts; which produce many new kinds, and those not barren; contrary to your general opinion, we produce numberless kinds of serpents, worms, flies, and fishes, by means of putrefaction; some whereof advance to be perfect creatures, like beasts or birds, and propagate. Neither is this the effect of chance; but we know beforehand, from what matter, and commixture, and of what kind these creatures will arise."—*Bacon. The New Atlantis; or Plan of a Philosophical Society. Shaw's Translation.*

"Many important discoveries in the animal economy have originated in experiments first made on brutes, which could not have been made upon the human subject; for example, the experiments relating to the circulation of the blood, perspiration, muscular motion, the sensibility, direct

ability of different parts of the body, and the effects of various medicines.”
—*Dr. Rees's Cyclopædia*.

“ During his residence at Oxford, Wren, in anatomical science, stood amongst the first professors of his day, and as early as the age of 15, he was employed by Sir Charles Scarborough, an eminent physician and mathematician, as a demonstrating assistant. His abilities as a demonstrator, and his attainments in anatomy generally, are acknowledged by Dr. Wills in his treatise on the brain, for which he made all the drawings, and he is allowed to have been the originator of the physiological experiment of injecting various liquors into the veins of living animals, which Bishop Spratt called a “ noble experiment ” exhibited at the meetings at Oxford.

This experiment is alluded to by Sir Christopher Wren himself, in a letter to a friend in Ireland, (conceived by Mr. Elmes to be Sir William Petty.) “ The most considerable experiment I have made of late is this : Injected wine and ale into the mass of blood in a living dog by a vein, in good quantities, till he became extremely drunk ; but soon after voided it by urine. It will be too long to tell you the effects of opium, scammony, and other things which I have tried in this way. I am in further pursuit of the experiment, which I take to be of great concernment, and what will give great light to the theory and practice of physic.”—*Life of Sir C. Wren*, Lib. Useful Know.

(12.) “ To say something, then, of physick, and to suppose the fitness of the now received division of it into five parts, the physiological (the physician taking that in a stricter sense than the philosopher, and than we do everywhere save in this essay,) pathological, semeiotical, hygiernal, and therapeutical ; let us briefly take notice how each of these is indebted to, or capable of, being improved by experienced naturalists. And indeed such is the affinity between natural philosophy and physick, or the dependence of this on that, that we need not wonder at the judicious observation of Aristotle, where he thus writes : “ *Naturalium fere plurimis et medicorum, qui magis philosophiæ artem persequuntur illi quidem finiunt ad ea quæ de hi vero ex iis quæ de natura, incipiunt quæ de medicina.* ” This is the course of naturalists and physicians, who prosecute their art philosophically ; the naturalist ends where medicine begins, and medicine begins where the naturalist endeth.” But we must instance these things more particularly ; and first for physiology : it is apparent that the physician takes much of his doctrine in that part of his art from the naturalist ; and to mention now no other part of physiology in its stricter acception, the experience of our own age may suffice to manifest what light the anatomical doctrine of man's body

may receive from experiments made on other subjects, and because I have not yet met with any author that professes himself not to relate this experiment (of the exemption of a dog's spleen) upon the credit of others but as an eye-witness; I am content to assure you, that that dextrous dissector, *Dr. Jolive* (of whom we formerly made mention), did the last year, at my request, take out the spleen of a young setting dog I brought him; and that it might not be pretended the experiment was unfaithfully or favourably made, I did part of it myself, and held the spleen (which was the largest in proportion to his body that ever I saw) in my hand, whilst he cut asunder the vessels reaching to it, that I might be sure there was not the least part of the spleen left unextirpated; and yet this puppy, in less than a fortnight, grew not only well, but as sportive and wanton as before; which I need not take pains to make you believe, since you often saw him at your mother's house, whence at length he was stolen. And though I remember the famous empiric *Fioravanti*, in one of his Italian books, mentions his having been prevailed with by the importunity of a lady, (whom he calls *Marulla Græca*) much afflicted with splenetic distempers, to rid her of her spleen; and adds that she outlived the loss of it divers years, yet he that considers the situation of that part, and the considerableness of vessels belonging to it in human bodies, will probably be apt to think that though his relation may be credited, his venturousness ought not to be imitated. The experiment, also, of detaining frogs under water for very many hours (sometimes amounting to some days) without suffocation, may to him that knows that frogs have lungs, and breathe as well as other terrestrial animals, appear a considerable discovery, in order to the determining the nature of respiration. Besides, the scrupulousness of the parents or friends of the deceased persons deprives us sometimes of the opportunities of anatomising the bodies of men, and much more those of women; whereas those of beasts are always and everywhere to be met with. And it was, perhaps, upon some such account that *Aristotle* said, that the external parts of the body were best known in men; the internal in beasts. *Sunt enim* (says he, speaking of the internal parts) *hominum imprimis incertæ atque incognitæ; quomobrem at cæterorum animalium partes, quarum similes sunt humanæ, referentes eas contemplari debemus*: 'The parts of the human body are unknown, and therefore we ought to consider them by the parts of other animals to which they are alike.'—[Mr. Boyle goes on to say, that the greatest analogy exists between androtomy and zootomy; that "*Galen's* knives were much more conversant with the bodies of apes, and other brutes, than with those of man." He details experiments performed on

the lungs of vipers, and other creatures; and the results which followed the cutting out of the heart in flounders and frogs, by himself; he details "Observations of the motion of a chicken's heart, after the head and other parts were cut off;" "Of the vivacity of dissected vipers and tortoises, whether there be a necessity of the unnecessary influence of the brain to sense and motion;" "That the silkworm butterfly is capable of procreation after the loss of its head;" with many other illustrations. We cannot refrain from giving the following important paragraph in full. "The doctrine so universally delivered by physicians and chirurgeons concerning irreparable loss of the limb of an animal, once violently severed from the body, will appear to be unfit to be admitted, without some restriction, by what may be experienced in lizards, lobsters, and craw-fish, and perhaps in some other living creatures. For of lizards, it hath been often observed in hot countries, and even in France, that their tails, being struck off, will grow again. And the like hath been of old observed by *Pliny*; and the experienced *Bontius* delivers it upon his own knowledge in these words:—*Hoc in domesticis meis non semel animadverti, dum filii mei lusitabundi bacillo caudas iis decutiebant, quas tamen post diem unum aut alterum ad solitam pabulum revertentes vidi, caudasque iis paulatim reaccrescere*: "This I have more than once observed in lizards which I kept in my house. For my children being at play, when with a rod they had struck off the lizard's tails, I saw them within a day or two come out to feed, and their tails then by little and little still increasing, and growing bigger." I could willingly transcribe other passages from Mr. Boyle's celebrated work, especially those pages titled "Of the Usefulness of Natural Philosophy in reference to the mind of man," but I must refer the reader to the original, which, unfortunately for the many, can only be found in University towns. A reprint of Mr. Boyle's several essays under this head would form a very valuable and acceptable little volume to the student of medicine. AUTHOR.]

13. "To the late Mr. J. Hunter, Dr. Goodwin, Spallanzani, and a few others, we are eminently indebted for many valuable facts obtained through the medium of experiments performed on living animals. These facts acquire their intrinsic worth, from their exposing to our view internal operations which were before concealed; thereby manifesting the natural condition of things without altering it."

"Cruel and horrible as these experiments were, if they cannot be justified, it is hoped that they will find considerable palliation in the motive which led to the execution of them: the earnest hope which a few of these gentlemen entertained of bringing light out of darkness, and that

the sufferings of the brute might ultimately prove beneficial to man. Although humanity feels a pang at the recollection of such pursuits, they ought nevertheless to be tolerated to a certain degree, when performed by those who, having an end in view, are anxious to prove, by the fact of the experiment, the truth or error of the principles of physiological science entertained by them."—*The Principles of Physiological and Physical Science, &c.* By Richard Saumarez, Esq., 1812.

14. "The chyliiferous vessels were unknown to the ancients. The honour of the discovery is due to Gaspard Aselli, of Cremona, who, in 1622, at the solicitation of some friends, undertook the dissection of a living dog, which had just eaten, in order to demonstrate the recurrent nerves. On opening the abdomen, he perceived a multitude of white very delicate filaments crossing the mesentery in all directions. At first, he took them to be nerves; but having accidentally cut one, he saw a considerable quantity of a white liquor exude, analogous to cream. Aselli also noticed the valves, but he fell into an important error regarding the destination of the vessels, making them collect in the pancreas, and from thence to the liver."—*Dr. Duglison's Physiology, Vol. II. p. 11.*

15. "If the correctness of the preceding explanation of the sensation of hunger be thought to stand in need of confirmation, I would refer to the very conclusive experiments by Brachet of Lyons, as setting the question entirely at rest. Brachet starved a dog for twenty-four hours, till it became ravenously hungry, after which he divided the nerves which convey to the brain a sense of the condition of the stomach. He then placed food within its reach, but the animal, which a moment before was impatient to be fed, went and lay quietly down, as if hunger had never been experienced. When meat was brought close to it, it began to eat, and apparently from having no longer any consciousness of the state of its stomach whether it was full or empty—it continued to eat till both it and the gullet were inordinately distended. In this, however, the dog was evidently impelled solely by the gratification of the sense of taste; for on removing the food at the beginning of the experiment to the distance of even a few inches, it looked on with indifference, and made no attempt either to follow the dish, or to prevent its removal."—*Brachet, Recherches Experimentales sur les Fonctions du Systeme Nerveux Ganglionaire Chap. III.*

"Precisely similar results ensued when the nervous communication between the stomach and brain was arrested by the administration of narcotics. A dog suffering from hunger turned listlessly from its food when a few grains of opium were introduced into its stomach. It may

be said that such a result is owing to the drug being absorbed and carried to the brain through the ordinary medium of the circulation ; but Brachet has proved that this is not the case, and that the influence is principally exerted upon the nerves. To establish this point, two dogs of the same size were selected ; in one the nerves of communication were left untouched, and in the other they were divided. Six grains of opium were then given to each at the same moment. The sound dog began *immediately* to feel the effects of the opium, and became stupid, while the other continued lying at the fireside for a long time without any unusual appearance, except a little difficulty of breathing. In like manner, when the experiment was repeated with that powerful poison *nux vomica*, upon two dogs similarly circumstanced, the sound one fell *instantly* into convulsions, while the other continued for a long time as if nothing had happened.

“ These results demonstrate, beyond the possibility of doubt, the necessity of a free nervous communication between the stomach and brain, for enabling us to experience the sensation of hunger.”—*The Physiology of Digestion*, by Andrew Combe, M.D., p. 14.

“ He (Boerhaave) diligently perused Vesalius, Fallopius, and Bartholin, oftentimes dissecting brutes alive with his own hand, and attending the public dissections of Professor Nuek ; nay, the very slaughter-houses did not escape him, wherein he confessed many useful observations had occurred to him. So far was he from yielding an implicit faith to authority, or from declining the irksome but profitable labour of dissecting and exploring bodies with his own hands and eyes, alike qualified with patience to observe, and fidelity to deliver the dictates of nature.”—*Dr. Burton's Life of Dr. H. Boerhaave* ; 1746. Part 1. ; p. 14.

“ In the beginning of summer 1778, I was conversing with Dr. Hunter on this subject (experiments in which, on the third day, after impregnation, the ova of rabbits were found in the Fallopian tubes ; and on the fourth day after impregnation in the uterus itself ; with the first appearances of the fetus ; by William Cruickshank, Esq. ; communicated by Everard Home, Esq., F.R.S. ; read, March 23, 1797), and said ‘ I should like to repeat those experiments, now that lectures are over, and that I have the summer to myself.’ ‘ You shall make the experiments,’ said he, ‘ and I shall be at all the expense.’ Accordingly he carried me to Chelsea, introduced me to a man who kept a rabbit warren, and desired him to let me have as many rabbits as I pleased. I made the experiments, and shall now lay a copy of my journals then made, before this Society.”

Dr. Barry says, "They who inveigh most loudly against experiments upon living animals, and affect an excess of sensibility, have never made any experiments themselves. They are contented with the exposition of what they in their wisdom suppose nature ought to do, instead of investigating what she actually does."

"Others talk of needless cruelty. If any useful knowledge is to be obtained by an experiment, none of the means necessary to arrive at this knowledge can be needless, and none else can be adopted without defeating the purpose aimed at; therefore, in useful experiments, there never is needless cruelty, or, in other words, unnecessary pain inflicted.

"When medical men are praised at public meetings, and their letters there read with applause, in which they profess the determination neither to open the living book of animal nature themselves, nor permit it to be opened by the youth committed to their charge, our best feelings are allowed to take a very wrong direction. There are those, however, who have had the candour and the honesty to assert, in the face of this vulgar clamour, that we have as good a right to make animal life subservient to the increase of our useful knowledge, as of our bodily strength and amusements."

"This is plain common sense, and must in the end prevail." We at least did not betray our duty by keeping silent when hypocritical cant was usurping the place of true philanthropy.—*Medico Chirurg. Review*—Vol. V. New Series, p. 313.

19. *Vivisections*. "We need hardly remind our readers, that we have uniformly reprobated the extravagant rage for vivisections now pervading many parts of the Continent, more especially France. But in so doing we as uniformly maintained that experiments on animals, when carried on for the purpose of elucidating problems in Physiology, Pathology, or Therapeutics, and conducted with all possible care to avoid unnecessary cruelty, were justifiable. In this country vivisections are so exceedingly rare, that we could not but consider the 'no cruelty' cry, (a worthy successor to 'no Popery') which has been lately raised by a party in the profession, as neither more nor less than a hypocritical cant to curry favour with the extra professional saints, and thus promote their own private interests. The violent rage engendered by this expression of ours among these conscientious Medico-Martinetts, may be estimated by the following epistle, from a town that has long flourished by the blood which followed the stripes of the negro-driver:—

' *Liverpool, 29th April, 1825.*

' Sir,—I cannot resist addressing you as the avowed advocate of *cruelty*

and *inhumanity*, and were I personally acquainted with you I should entreat you direct. In your 'Quarterly Journal,' I read it to be *hypocrisy* in the medical men to abstain from cruelly torturing animals, for (as you would term it) useful purposes. Let me ask you what has the injection of urine, as performed by Blundell, done for the good of society? We all know how you would speak—if one drop should get between the coats of your intestines—but we should not regret the consequence, to such a monster. I say it is laudable, that men, professing humanity, should shew the world that unnecessary experiments are abhorred by them (you must know we have had bad name enough for that.) When it is lawful, pray let it be sanctioned by others, and not that every whipster should plunge a blunt knife into the chest of an animal to see which way the blood flows. Lastly, you will find a deficit somewhere, scratch my name (the name of an anonymous dastard!) out as a subscriber to your journal, in many respects a valuable one, and if you continue to hold up such doctrine, I shall continue to believe you some dog-butcher, and unworthy the name of a physician.'

"This is the language of men affecting such delicacy of feeling, and scruples of conscience, that they shudder at the inhumanity of pushing a needle through the web of a frog's foot, while they can lick their lips and stroke their paunches at the sight of eels skinned *alive* and afterwards fried *alive*, fish earped *alive*, lobsters boiled *alive*, or eaten *alive*, &c. ! They will say 'oh this is necessary cruelty.' Do we not, before sitting down to a table covered with these victims, turn up our eyes and cry—'Lord bless *these creatures to our use*, and us to thy service, &c.' We do like consistency, and therefore maintain that the advocates for sparing the lives of animals from the surgeon's knife, and for the ultimate good of the human race—in the other for the sake of pampering the appetite and laying the foundation of innumerable diseases.*

"This 'no-cruelty' cry is levelled at the memory of the illustrious dead, and the moral character of the meritorious living. Among the experimenters on animals with scientific views, are almost all the names that grace and honour our profession. A Galen, a Harvey, a Haller, a Spallanzani, a Hunter, a Brodie, a Bell, a Philip, and many other distinguished names

* We venture to affirm, without fear of contradiction, that there is more physical torture inflicted, and mental agony occasioned, among animals, in one winter in England, by hounds and guns, than during two thousand years by physiological experiments. Yet the former are looked upon without any other emotion than that of pleasure, while the latter are held up as instances of unparalleled inhumanity. Such is the consistency of the pseudo-philanthropist.

among the living of our own country. These are the men whose memories are to be aspersed, and characters assailed by a set of canting hypocrites, who, having neither zeal nor talents themselves, endeavour to gain popularity by vituperating their superiors.

"We say again, we like consistency. We could not, therefore, but be amused, while reading a long medical sermon, in the newspaper, from the *Nimrod* of Dublin, on cruelty to animals.

"The man who had no sooner finished his homily on the inhumanity of pithing a *rabbit*, than he mounted his courser and hunted to death an innocent *hare*! The argument cannot be held that we are compelled to eat animal food—whole nations, as the Hindoos, live on vegetable substances, and enjoy good health. The Irish peasant seldom tastes animal food, and is remarkably robust. If, therefore, we wish to respect the lives and feelings of the animal kingdom, let us turn to vegetable diet. But what excuse can be offered for the conduct of the sportsman, who wantonly destroys myriads of the most innocent animals, while, like the tiger, he can only make use of a few ounces himself;—yet these are the men who raise the "no cruelty" cry against the physiologist for making a few solitary experiments on the lower animals, with the express design of saving human sufferings.

"We repeat what we have often urged in this Journal, that we reprobate the indiscriminate and senseless experiments of some of the continental physicians; but we do maintain that the interested cry against physiological experiments in this country (where they are proverbially rare) is a disgrace to those who have raised it, and we shall never cease to tell them so, be they high or low in the profession."—*Medico-Chirurg. Review*, Vol. 3, new series, p. 198, superintended by Dr. James Johnson.

The editor of the *Lancet* makes the following remarks on Mr. Chippendale's reply (Novr. 16, 1838) to "Surgical Experiments on Living Animals," by Lewis Gompertz, Hon. Sec. Oval Kennington—footnote. "Mr. Chippendale has bestowed, we think, too much notice upon a set of men whose zeal hath eaten up their wisdom. We are as ready to deprecate the infliction of *wanton* cruelty upon animals as the society in question, but we defy them to prove that the experiments upon animals, instituted in this country, are either wanton or come within the meaning of the Act."—ED. I.—*Lancet*, Vol. I., for 1838-9, p. 357.

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